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Young people, ICT and energy - status and trends in young people's use and understanding of ICT and energy consumption

D2.1 Technical Report on the Organisation and Outcomes of Focus Groups and the Mapping Exercise

Christensen, Toke Haunstrup; Mourik, Ruth; Breukers, Sylvia; Mathijsen, Tomas; Heuve, Herjan van den

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Peer-to-peer education for youths on smart use of Information and Communication Technologies

D2.1 Technical Report on the Organisation and Outcomes of Focus Groups and the Mapping Exercise

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Coordinator name/ organisation/ e-mail/ telephone number:
Jennifer Dahmen
University of Wuppertal - Germany
jdahmen@uni-wuppertal.de
+49 202 439 3181

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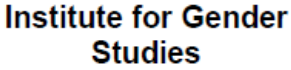

Young people, ICT and energy

Status and trends in young people's use and understanding of ICT and energy consumption

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1. Introduction

This report is the outcome of the Intelligent Energy Europe (IEE) project *Peer-to-peer education for youths on smart use of Information and Communication Technologies* (in short: useITsmartly). The useITsmartly project aims at reducing the energy consumption related to use of ICT (Information and Communication Technology) through developing innovative solutions to facilitate young people's capacity building of smart ICT use and ideas on how to reach them in relation to this. The project focuses on young people aged 16-20 years and involves partners from five countries: Germany, the Netherlands, Austria, Norway and Denmark. For more information about the useITsmartly project, visit the project website at: www.useitsmartly.com.

The background for the useITsmartly project is the significant increase over the last decades in the energy consumption related to ICT devices. The increase seems to continue – and today, ICT represents about a quarter to one-third of the total electricity consumption in European households. In addition, the use of ICT also involves "hidden" energy and resource consumption related to the manufacturing and disposal of devices as well as the use of the internet for data transmission etc. ICT has therefore become an important consumption area for strategies aimed at reducing energy consumption – and young people are a main target group due to their intensive use of ICT.

This report is a deliverable from Work package 2 of the useITsmartly project. The aim of the work package is to establish the knowledge basis for developing methods to change ICT user practices and technology in a less energy-intensive direction. This has been done through providing knowledge about attitudes, know-how and practices of ICT use among young people (including their understanding of the link between their personal use of ICT and implications for energy and climate). The work package serves as a basis for the later work packages, e.g. Work package 3 that develops ideas on how to reduce young people's energy consumption.

There are two overall goals of the study reported here: The first goal has been to provide an overview of which ICT practices that are particularly important to change in relation to energy consumption, as well as mapping current technological and social trends, enablers and barriers for reducing energy consumption from ICT use. This has been done through a literature review of studies about the energy implications of ICT usage, including comments on current technological trends (the results of this literature review are reported in chapter 3). As part of this, a survey of national studies on energy consumption related to the use of ICT in households has been carried out for all countries (chapter 4). In addition, a literature review of studies on young people's use of ICT in their everyday life has also been carried out (chapter 5).

The second goal of the study has been to study young peoples' knowledge, attitudes and practices of ICT use in order to customize and target later activities and campaigns aimed at capacity building and changing young peoples' use of ICT. This has been done through carrying out focus groups with young people in all countries participating in the useITsmartly project. The method of the focus groups is described in chapter 6 and the focus groups results are reported and analysed in chapter 7-9.

Finally, the findings from the literature reviews and the focus groups are combined and analysed in chapter 10, and the overall findings of the study are summarized in the concluding chapter 11.

This report both presents the technical details of the organisation of the study (in particular the approach and methods related to the focus groups, which represent a primary activity of this work package) as well as the empirical findings, analytical results and conclusions. Later, a short, analytical report aimed at the public and summarising the main conclusions and recommendations for policy makers will be published (planned for publication in spring 2014).

The study has been lead by Toke Haunstrup Christensen (Danish Building Research Institute, Aalborg University) and performed in close collaboration with the partners of the useITsmartly project. Partners involved in carrying out the focus groups were Radboud University, University of Wuppertal, Norwegian University of Science and Technology, Lokal Energy and Inter-University Research Centre for Technology, Work and Culture. In addition, Dune Work has provided the literature review on ICT user practices among young people and Smart Homes has contributed with data and literature reviews for the mapping of energy consumption and technological trends and user patterns. Finally, the design of the focus groups was developed in close cooperation with Els Rommes (Radboud University) and with input from all partners.

Before presenting the outcomes of this study, the next chapter presents an overall framework for understanding different types of energy implications related to the use of ICT.

2. ICT and energy consumption – conceptualising the link

Before presenting the results of our review of studies on ICT use and energy consumption (chapter 3 and 4), we will start with introducing an overall framework for understanding the different types of energy-implications of ICT usage.

2.1 Conceptualising the relations between ICT and energy consumption

In the literature on broader environmental impacts of ICT, it is common to distinguish between first-, second- and third-order effects (Hilty 2008; OECD 2010): First-order effects are defined as the direct impact of ICTs on the environment. These are the impacts related to the physical existence of ICT. These effects are in general negative as they are related to the environmental impacts of production, use, recycling and disposal of ICT hardware (Hilty 2008). In this way, first-order effects relate to classical Life-Cycle Assessment (LCA) studies, and different types of ICT devices will typically have different first-order effects depending on how they are produced, their energy efficiency during the use phase and how they are disposed.

Second-order effects are defined as the "indirect environmental effects of ICT due to its power to change processes (such as production, transport or consumption processes), resulting in a decrease or increase of the environmental impacts of these processes" (Hilty 2008: 16). Much literature has focused on the potential positive environmental impacts of the application of ICT – for instance studies of replacing traditional physical music media (CDs) with digital, online music purchase and streaming (Weber et al. 2010) or studies of online news reading or e-books replacing traditional paper media like physical books, newspapers or magazines (e.g. Achachlouei et al. 2013, Moberg 2010). Digitalising previous consumer goods is often described as a result of the potential of ICT for dematerialising consumption. For the same reason, these (positive) effects of ICT usage are also termed the "enabling impacts of ICTs" by OECD (2010). However, second-order effects might also be negative, e.g. in cases where the integration of ICT involves new practices with higher resource consumption. A classical example of this is the use of printers at offices and in homes, which have resulted in an increase in the overall paper consumption for printing. OECD (2010) identifies four ways in which ICT products can affect the environmental footprint of other products and activities: Optimisation (use ICT to reduce the environmental impact of another product); dematerialisation and substitution (replacing physical products/processes by digital products/processes); induction (ICT products that help to increase demand for other products; e.g. increased demand for paper due to printers; and degradation (problems for local waste management due to the embedding of ICT-devices in non-ICT products).

Third-order effects relate to the "environmental effects of the medium- or long-term adaptation of behaviour (e.g. consumption patterns) and economic structures to the availability of ICT and the services it provides" (Hilty 2010: 16). In practice, it can be difficult to distinguish clearly between second- and third-order effects, but while second-order effects focus particularly at the level of specific consumption activities (and how the integration of ICT into these have implications for the environmental impact of these activities), the third-order effects focus on the more general and systemic implications of ICTs on the environmental impact of behaviour (practices) and the economy. Examples of third-order effects include (from OECD 2010): ICT used for smart grid solutions aimed at reducing the overall energy consumption or integrating renewable energy sources (feedback to households about energy consumption patterns, demand-side management etc.); environmental impacts of overall changes in economy and consumption patterns; rebound effects related to higher efficiency; etc.

The following table summarizes the main characteristics of first-, second- and third-order effects of ICTs. It also identifies effects related to households and outside households, although this distinction is primarily applicable for the first-order and (to some degree) the second-order effect, while the distinction between the household as a local unit of order and the "surrounding" socio-technical systems and institutions (which the household is part of) is rather problematic when it comes to the systemic impacts (third-order effects). Also, as indicated by the broken lines, the distinction between second- and third-order effects is in many cases open for interpretation.

		Household level	Outside the household
1st order effects (direct impacts)	Product level Life-Cycle Assessments	Electricity consumption related to the use of ICT (e.g. charging of batteries; standby power consumption; etc.) [Direct electricity consumption]	Energy consumption related to the production and distribution of ICT products (embodied energy) and recycling and disposal of ICT. All other phases of the product lifecycle than the use phase.
2nd order effects (enabling impacts)	Activity level: Energy consumption related to specific activities/ practices (e.g. reading news, communication, shopping etc.)	Changes related to the energy consumption for different activities due to the application of ICT. Focus on implications of ICT use for other consumption areas (e.g. transport) E.g. reading texts on screen instead of on paper ⇒ increase in electricity cons. for ICT devices; e-commerce instead of buying products in shops ⇒ potential reduction in household's energy cons. for transport, but maybe higher electricity consumption for use of ICT devices; etc.	Derived effects for energy consumption outside the household (in the socio-technical systems, which the household is part of). E.g. energy cons. related to the internet infrastructure and data centres – and also other types of energy consumption related to e.g. transport of goods (e-commerce) etc.
3rd order effects (systemic impacts)	Systemic level: Energy impacts of economy-wide changes on a medium- and long-term scale (changes in social structures, consump-tion/production patterns etc.)	(No clear distinction between energy implications in/outside households at the systemic level)	

The practice theoretical perspective, which focuses on practices as collective entities of doings and sayings, does not fit easily with the typology of first-, second- and third-order effects. By placing practices in the centre of the analysis, this perspective cuts across the distinction between the levels of the product, activity and system. In a sense, social practices is most closely associated with the activity level perspective (second-order effects), as activities and routines are important parts of the performance of practices. However, practices also involve the use of material objects (the product level) as well as are related to the production and reproduction of overall socio-technical structures (the third-order level).

The classical and widespread distinction between direct and indirect energy consumption is in general problematic. For instance, it might be obvious that the electricity consumption for ICT devices (e.g. a smart phone) is a direct electricity consumption, but what about the electricity consumption of the data processing at the data centres that is related to the use of these devices for, e.g., streaming a movie? In a sense, this is also "direct" electricity consumption, as it is a direct outcome of your use of the device. On the other hand, this type of consumption may take place at different locations at the same time.

Thus, the distinction between direct and indirect energy consumption seems not fruitful and constructive when it comes to this kind of complex relationships between activities/uses, technologies and infrastructures. Instead, a more relevant distinction might be between energy consumption at the household level (for ICT in

the form of electricity consumption for ICT devices) versus the other types of energy consumption taking place outside the household domain (related to the ICT infrastructure, the provision of internet services, overall systemic changes etc.).

In addition to the general concepts above, we will also use the following (and more specific) terms for different types of energy consumption related to the use of ICT:

- **Direct electricity consumption**: The electricity consumption *directly related to the use of ICT devices* (e.g. for PCs/laptops, charging batteries of mobile phones or other gadgets, etc.). Much of this electricity consumption happens within the home (and thus contributes to the residential electricity consumption) – but as many ICT devices are portable (e.g. laptops, tablets and mobile/smart phones), some of the direct electricity consumption will also happen outside the home. This concept is related to the first-order effects.
- **Embodied energy consumption**: Is the energy consumption related to all other life-cycle phases of ICT products; i.e. to the production of ICT devices (including energy consumption for extraction and manufacturing of raw materials/metals) and for the disposal and waste handling phase. This concept is also related to the first-order effects.
- **Internet-related energy consumption**: Is the energy consumption related to the provision of internet-based services accessed by ICT devices (e.g. video streaming, social media, e-mail etc.). This includes the energy consumption for *internet data traffic* (the infrastructure for transmission of data between users and data centres etc.) and for *storing and processing* data at data centres. This might (in some studies) also include the energy consumption related to access networks (providing the access to the internet; e.g. local area network (LAN) that the user is connected to at home or mobile broadband connections. Internet-related energy consumption is related to the second-order effects.

The following chapter will present a literature review of studies on energy consumption related to the use of ICT.

Part I: Framing the challenge

3. Identifying energy-intensive uses of ICT

On the basis of a review of studies of the energy implications of ICT, this chapter aims at identifying the most energy-intensive uses of ICT. In this way, the chapter will contribute to determine the activities and practices that are most relevant (in energy terms) to address in this project.

As L. M. Hilty points out, studies on the environmental impacts of ICT "faces the problem that both the technology and the way it is shaped and used by society are changing fast" (Hilty 2010: 16). In this way, the efforts to draw an overall picture of the energy implications of the use of ICT can be compared to trying to hunt down a constantly moving target. Reviews of the current knowledge on ICT and energy will therefore always have the character of a snapshot, showing the situation and trends at the specific time of the study.

For the same reason, we will in the following combine studies of specific energy implications of ICT with more general studies and considerations with regard to the overall, basic principles and trends with regard to the relationship between ICT (usage) and energy consumption. Particularly, the aim will be to identify the types of devices (and their related usages) that in general are most energy-intensive. This will be important for the identification of the practices that the following work packages of useITsmartly should focus particularly on.

The general trend of increased use of ICT devices and services means that the potential energy savings from the increases in the energy efficiency of the ICT hardware are more than outweighed by the increase in the total ICT consumption (both measured by number of devices as well as the amount of time and activities that ICTs are being used for). The end result has until now been a steady growth in ICT-related energy consumption – both at the household-level as well as on a systemic level (increasing consumption for data centres etc.). This, despite otherwise impressive improvements in the resource productivity on the hardware level due to the so-called Moore's Law, according to which the performance of ICT doubles every 18-24 months with regard to processing power as well as storage capacity and data transmission rates. Thus, as estimated by Hilty (2008), *if* we had only increased our "consumption" of processing power by only a factor 10 over the last 20 years (instead of a factor 1000), "we should have been able to achieve an actual resource savings goal of a factor of 100, because we would have replaced each device with a small, lighter and energy-saving one every few years" (p. 149). Instead, we have increased our consumption of ICT at a higher rate than the rate of increasing hardware resource productivity. One example of this is related to the data transmission on the internet: Historically, the amount of data transmitted via the internet has had a steady growth, and this is expected to continue in the future. According to Malmodin et al. (2013), the global amount of internet data traffic is expected to increase by a factor of 50 between 2007 and 2020. During this period, also the carbon footprint of transmitting data is expected to increase, although only with a factor of 35 (lower due to increased energy efficiency). Thus, the potential energy savings from increased data transmission efficiency will be more than outweighed by the increase in the data traffic volume. These tendencies, and the reasons for them, are therefore interesting and important to investigate further.

In the following, the focus will be on first-order and second-order effects (with emphasize on first-order effects). We will not include third-order effects in this study. Not because third-order effects are not relevant and important; as pointed out by Hilty (2008), third-order effects actually play a key role in a possible, deep-structural dematerialisation of the economy, which would potentially imply considerable reductions in

consumption of energy and materials. The reason for not focusing on third-order effects is because the aim of useITsmartly is to develop ideas and solutions for a more energy efficient use of ICT in young people's everyday life. For the same reason, focus should be on energy aspects directly related to their ownership and daily use of ICT devices, which refers directly to first- and second-order effects. In comparison, third-order effects happens on a more general and systemic level, which of course do involve the users as part of the production and reproduction of overall socio-technical structures and collective practices, but with a much less clear link between the individual practices and the overall, structural changes.

The complexity of conceptualising and describing (possible) third-order effects of ICTs is also reflected in the general lack of literature on this. While there is considerable literature on (particularly) first-order and second-order effects, only few studies have addressed the more general and systemic third-order effects (among the exceptions are: Erdmann & Hilty 2010; Hilty 2008; OECD 2010; Røpke & Christensen 2012).

3.1 Total energy consumption and greenhouse gas emissions from the global ICT sector

The Malmodin et al. (2010) study shows that on global scale, the ICT sector[1] caused 1.3% of the global greenhouse gas (GHG) emissions in 2007, while the entertainment & media sector[2] (including printed media) represented 1.7%. Thus, the two sectors represented in total (and if excluding printed media) about 2.3% of the global GHG emissions in 2007. The figures for global electricity use were 3.9% for ICT and 3.2% for entertainment & media (including printed media) – or about 7.1% of the global electricity use in total. The study was based on a life cycle perspective on energy consumption – however, only the operational (user) phase was included for electricity.

The results of the Malmodin et al. (2010) study also show that for the ICT sector, PCs (desktops and laptops) represented the largest share of the estimated 2007 GHG emissions (about 40% of all GHG emissions related to ICT); the major part of this (about 60%) was related to operation (use) of the PCs. However, the second largest contributor to ICT-related GHG emissions is data centres (about 27% of all GHG emissions related to ICT); the major part of this (about 64%) relates to the electricity consumption for operating the data centres.

For the entertainment & media sector, TVs & peripherals (i.e. TV-related devices like desk-top boxes etc.) is by far the largest contributor to the global 2007 GHG-emissions (if paper and printed media is not included). Thus, TVs & peripherals represented about 75% of the global GHG emissions related to entertainment & media sector (printed media not included), while the remaining 25% is other hardware like MP3 players, digital cameras etc.

3.2 ICT devices

Mobile phones (not smart phones)

According to Malmodin et al. 2010, an average mobile phone requires 3 kWh/year for charging – or about 2 kg CO_2e /year (CO_2e means CO_2-equivalents). Furthermore, the manufacture of a mobile phone (including background emissions) results in 18 kg CO_2e emissions per phone.

[1] In this study defined as mobile and fixed telecommunication networks – including broadband – data centers, enterprise networks, transport networks related to the ICT infrastructure as well as the end user equipment such as phones, PCs and modems

[2] To this category was included: TV sets (including TV peripherals like set-top boxes, DVD players, game consoles and the like), printed media and a range of consumer electronic products (like MP3 players, digital cameras etc.). Notice that printed media represents about one-third of the total 2007-GHG emissions estimated for the entertainment & media sector.

As it can be seen from these figures, the major part of the energy consumption (and GHG emissions) is related to **manufacturing** for mobile phones. If, for instance, the average operation life time of a mobile phone is about 2 years, the ratio of GHG emissions between manufacturing and use phase would be around 18 kg / 4 kg = 4.5 (meaning that seen over the life-cycle of the mobile phone, more than four times GHG emission would be related to manufacturing than the use phase).

Smart phones

The energy consumption and the greenhouse gas emissions related to smart phones are in general higher than for mobile phones. The difference is mainly due to higher environmental costs related to the manufacturing of smart phones. Thus, a LCA study by Nokia shows that the climate change impact of a basic mobile phone (in this study a Nokia 105) equals 7 kg CO_2e, whereas the impact of a smart phone (a Lumia 720) is three times higher (21 kg CO_2e). For the smart phone, the GHG emission related to the usage phase only represents about 10% of the total emissions, whereas the same figure for the basic mobile phone is about 20%. (Santavaara & Paronen 2013) Similarly, Sony finds that the GHG emissions of producing "high-end phones" (e.g. smart phones) in general are higher than for traditional ("low-end") mobile phones (Sony 2013). Thus, for smart phones, the **manufacturing** is even more important for the overall energy consumption and climate impact than it is for mobile phones.

Desktops ("stationary" PCs)

For desktops ("traditional" or "stationary" PCs), Malmodin et al. (2010) find that the CO_2 emissions related to manufacturing on average equals 270 kg CO_2e / desktop. However, it should be noticed that this is based on data from older studies from around 2006-2008, which means that the figure might have decreased somewhat due to increased energy efficiency of the manufacturing processes. With regard to the use (operation) of desktops in homes, Malmodin et al. find that this represents about 290 kWh/year on average – corresponding to about 174 kg CO_2e/year.

These figures show that for desktops, the main energy consumption (and GHG emissions) is related to the **use phase**. If – for instance – the operation life time of a desktop is about 4 years, the ratio of GHG emissions between manufacturing and use would be: 270/696 = 0.38. Thus, the GHG emissions associated with the use (operation) phase is up to three times the GHG emissions associated with the manufacturing.

Laptops

For laptops, Malmodin et al. (2010) find that the GHG emission from manufacturing is about 240 kg CO_2e / laptop. In comparison, the GHG emission related to the use of laptops in homes is about 33 kg CO_2e / year (which corresponds to an annual electricity consumption of 55 kWh/years).

Thus, the main GHG emission for laptops is related to **manufacturing**. If the operation life time is assumed to be about 4 years for a laptop, the GHG emission ratio for manufacturing/use phase would be: 240/132 = 1.8. In other words, the GHG emissions associated with the manufacturing would be almost two times higher than the emissions related to the use phase.

Tablets

On the basis of a LCA screening of Apple's iPad2 model, Achachlouei et al. (2013) estimate that the GHG emission from the manufacturing of this tablet accounts to about 36 kg CO_2e – or almost the double of smart phones.

A study by the American-based Electric Power Research Institute shows that if assuming full battery charge every other day, the iPad-models from Apple consume between 7.2 kWh/year and 11.9 kWh/year (with the

latest model having the highest energy consumption) (EPRI 2012). The CO_2 emissions related to this electricity consumption depends on the electricity mix of the specific country. If taking Denmark as an example, an annual electricity consumption of 12 kWh would correspond to about 5-6 kg CO_2/year. If assuming that a tablet is used for about three years on average, the total CO_2 emissions related to the use phase would be about 15-18 kg CO_2. Thus, the GHG emission ratio for manufacturing/use phase would be: 36/18 = 2. In other words, seen in a life-cycle perspective, the **manufacturing** accounts for about the double amount of GHG emissions compared with the use phase.

TV sets

According to Malmodin et al. (2010), the manufacturing of TV sets results in an average GHG emission of 300 kg CO_2e / TV set. With regard to the use phase, the study finds that the annual electricity consumption is about 200 kWh / TV set / year (however, as the figure is from 2007, this is mainly CRT television sets – these have today largely been replaced by other TV types, especially LCD screens).

For TV sets, the **operation (use) phase** represents by far the biggest share of the total GHG emissions (this is also the case for most TV accessories such as DVD players etc.). The ratio use phase/manufacturing is about 3.5, which means that seen over the entire life time of TV sets, the GHG emissions associated with their use phase is 3.5 times higher than the emissions related to the manufacturing of the TV sets. Thus, strategies aimed at reducing the energy consumption and GHG emissions related to TV sets should in particular focus on the use of TV.

3.3 Standby consumption

The energy consumption related to ICT devices in standby mode was among the first energy implications of ICT that came into focus. Standby consumption was originally introduced with the diffusion in the 1970s and 1980s of TV sets with remote controls. Later, standby modes were also integrated in many other ICT devices such as VHS players, computers, stereo sets etc. (Røpke et al. 2010) It is estimated that standby power consumption today accounts for about 10% of the residential electricity consumption (see studies reviewed in section 4.2).

As part of the EU Ecodesign Directive, regulation of standby and off mode power consumption was introduced in 2008. The Ecodesign Directive sets limits to the level of power consumption of a number of household and office equipments, including computers, TV sets, video recorders etc. However, the achievements with regard to reducing the standby energy consumption of single devices seem to be challenged by the overall increase in total the number of ICT devices. In addition, network standby is a new and emerging area of standby consumption that might contribute to new increases in standby consumption (IEA 2013). Network standby is related to the increasing number of products with constant access to the internet (always being connected to the network). Examples are set-top boxes and game consoles, which often need to be connected to the internet all the time, e.g. to ensure correct updating of television programmes or internal software. An example of network standby power consumption is reported in Hittinger (2011), who found that for a certain game console model, the standby power consumption would increase from 2 Watts to 9 Watts if it was connected to the internet.

The study by Hittinger also showed that for game consoles in general, the electricity consumption related to the use was small compared with the standby energy consumption if the consoles were not powered down between uses. Thus, the electricity consumption for a certain game console model increased from accounting for only 1% of the average residential electricity consumption if powered down between uses to accounting for about 15% of the residential electricity consumption if not powered down.

As the above illustrates, standby power consumption is still among the most important areas in relation to ICT and energy use.

3.4 Data traffic (internet data)

This category covers the energy consumption related to operate/maintain the infrastructure needed to transmit data between the users of ICTs and servers and data centres. More specifically, this includes the networks (fixed and mobile) on the telecom operator side (for instance: the antenna tower constructions for mobile phone communication and mobile broadband internet access) and the "backbone" (core) network of (typically) optical fibre connections between operators, regions and countries etc. In other words: The "road infrastructure" for digital data transmission via the internet. This includes the direct energy (electricity) consumption for operating this infrastructure as well as – depending on the choice of system boundaries – in some studies also the "indirect" energy consumption. The latter is related to the embodied energy of materials used in the infrastructure (e.g. concrete foundations for antenna towers) and/or energy consumption for transport and building heating related to the maintenance of the infrastructure.

Historically, the energy efficiency of data transmission has been increasing. According to Malmodin et al. (2013), the carbon footprint related to data transmission has gone down from about 75 kg CO_2e/GB (GB = Giga Byte) in 1995 to about 7 kg CO_2e/GB in 2007. This reduction is the combined result of technical improvements (higher technical efficiency) and increases in the amount of data transmitted. It is expected that the increase in energy efficiency will continue and that the GHG emissions per Giga Byte will be about 35 times lower by 2020 (i.e. about 0.2 kg CO_2e/GB).

Another study, Coroama et al. (2013), calculates the direct energy demand of internet data traffic to be about 0.2 kWh/GB (this study includes only transmission equipment, including electricity consumption for routers on sender and receiver sides). According to the authors, this is a conservative estimation; i.e. that they expect the "real" average energy consumption for data transmission to be somewhat lower. Included in this estimate is the direct power consumption for operating the transmission infrastructure (including related energy consumption for lightning, air-conditioning etc.) – but without including the embodied energy consumption of the transmission infrastructure.

Hinton et al. (2011) finds that at present, the energy consumption related to transmission of data over the internet is dominated by the energy consumption for the access equipment at the user side (i.e. routers in homes or offices). However, their model-based study also shows that with (expected) increases in the total amount of data transmission, the energy consumption related to the core network of the internet will increasingly become the main contributor to the overall electricity consumption for data transmission. Further, the study shows that the energy consumption is highly dependent on the type of access network (on the user side); power consumption for wireless-based access networks (i.e. "mobile broadband"; WiMAX and 3G/UMTS) are in general significantly higher than for wired connections like optical fibre connections. Finally, the study shows that the power consumption for downloading movies (IPTV) is highly dependent on the frequency of downloads of the specific movie (including both data transmission and data centres/video servers); thus, the power consumption per download increases with increasing popularity.

Examples of power consumption related to video/music streaming and downloads

Download rates for different services

Video streaming (movies): Streaming Netflix in medium quality (3 Mbit/s) corresponds to an hourly download of: 1.4 GB/hour. If a movie takes 1 ¾ hour, this corresponds to the download of: 1.75 * 1.4 = 2.4 GB.

Video streaming (YouTube): Streaming ordinary YouTube videos take 4-5 MB/minute or 240-300 MB/hour. Music streaming corresponds to 0.5-1 MB/minute or 30-60 MB/hour

E-books (downloading): App. 1 MB pr. book downloaded

Audio books (audio file): App. 500 MB pr. audio book downloaded

Sources: http://www.bbc.co.uk/webwise/guides/about-streaming and http://en.wikipedia.org/wiki/Netflix.

Power consumption for data transmission related to streaming

Based on the estimate by Coroama et al. (2013), the energy consumption for *data transmission* (per hour) can be calculated as:

- Netflix (streaming in medium quality, 3 Mbit/s): 1.4 * 0.2 = 0.28 kWh/hour (i.e. a 1.75 hour movie would be: 0.5 kWh). The power consumption would be 3 Mbit/s * 89.7 W/Mbit/s = 269 W[3]
- Netflix (streaming in high quality, 5 Mbit/s): Corresponds to energy consumption per hour of 5/3*0.28 = 0,47 kWh/hour (i.e. a 1.75 hour movie would be: 0.8 kWh) or the power consumption of 5*89.7 = 449 W (which is a relatively high power consumption – and typically about the same size of the power consumption of the TV set in itself or even lower)
- YouTube video streaming: 0.270 * 0.2 = 0.054 kWh/hour (or about 54 W)
- Music streaming: 0.045 * 0.2 = 0.009 kWh/hour (or about 9 W)
- E-books (downloading): 0.2 Wh (0.0002 kWh) (example in Coroama et al. 2013)
- Audiobooks (audio file): 0.1 kWh (Do.)

Studies like those above in general show that the internet access technologies at the user-side are significant contributors to the overall power consumption for transmitting data via the internet. For the same reason, the users' choice of access technology is important, as different technologies have different energy efficiencies. Overall, traditional wired broadband access technologies (like cable connections / Ethernet) are in general more energy efficient than wireless internet connections like wi-fi and – in particular – mobile wireless access technologies (mobile broadband) using 3G or 4G LTE mobile networks. Thus, a study by CEET (2013) finds that the average 2010 power consumption for 4G/LTE mobile broad band and home-wi-fi (using tablet) connections is about 5 W. The study develops a scenario for power consumption in relation to future cloud services and concludes that access networks (and not data centre) will be the major part of the overall power consumption for cloud services.[4] The 2015 scenario estimates that on a global scale, the total annual energy consumption related to wireless cloud services might increase by 4-5 times compared with the 2012-level. The scenario estimates that the energy consumption to metro/core networks and data centres will be insignificant (representing only about 10% of the total energy consumption), whereas most of the energy consumption will be related to local wi-fi and – in particular – mobile broadband connections (4G LTE).

[3] For comparison, a traditional broadcasting tower (for terrestrial television broadcasting) might have a power consumption of 60 kW, which corresponds to the data transmission energy consumption of 60,000 W / 270 W = 222 simultaneous video streaming. In practice, traditional broadcasting towers would cover much more than 222 simultaneous viewers, which indicates that the energy efficiency of the old (terrestrial) broadcasting model is much higher than for television viewing based on streaming (IPTV).

[4] It should be noticed that the CEET (2013) study apply values for the power consumption related to the metro/core internet network that are considerable lower than other studies. For instance about 25-50 times lower than the Coroama et al. (2013).

Stories about the energy consumption related to the internet infrastructure (both for data transmission and data centres, see also next section) occasionally reach the popular news media – often with relatively dramatized headlines. For instance, the *Sunday Times* ran a news story on the 11 January 2009 about how "two Google searches from a desktop computer can generate about the same amount of carbon dioxide as boiling a kettle for a cup of tea" (Sunday Times 2009) or the "your iPhone use more energy than your refrigerator" news story that ran across the world in August 2013 (see e.g. Time Magazine 2013). Both news stories created a lot of debate and were also debunked by other researchers and commentators (for a critical comment on the Sunday Times story, see e.g. Carr 2009).

With regard to the latter story, the original source of this news story was the report *The Cloud Begins With Coal: Big Data, Big Networks, Big Infrastructure, and Big Power* by CEO at the *Digital Power Group* Mark P. Mills and funded by the *National Mining Association* and *American Coalition for Clean Coal Energy* (Mills 2013). The report caused critical comments, which resembles the discussions following previous statements by Mills and his co-authors about the high electricity consumption related to ICT (e.g. in the wake of his and Huber's 1999-article *Dig More Coal – the PCs are coming*, Huber & Mills 1999; the results of Huber & Mills were later repudiated by other researchers, see more about this in Røpke et al. 2007). The 2013-report of Mills states that the use of smart phones (or tablets) for watching an hour of video weekly "consumes annually more electricity in the remote networks than two new refrigerators use in a year" (Mills 2013: 3). Or in energy-terms, Mills finds that the annual electricity consumption for network electricity use, embodied energy for base stations (for the mobile broadband network) and the embodied energy of smart phones add up to about 700 kWh/year/phone. However, this was later criticised by other researchers for being over-estimates of the actual energy consumption. Thus, Koomey (2013) finds that using a smart phone to watch one hour of video streaming per weeks results in an annual electricity consumption of about 61 kWh/year. This includes energy consumption for operating the cellular network (4G), the embodied energy use for base stations (the cellular network) and embodied energy for smart phones.[5]

Even though the calculations of Mills appears to be grossly over-estimates of the actual energy consumption related to the operation of the internet network, other studies show (e.g. CEET 2013) that the increased use of internet services, including cloud computing, results in non-negligible energy consumption in the internet infrastructure. A main driver behind this is the continuous and almost exponential growth rate of the total data traffic.

3.5 Data centres

This category covers the energy consumption related to the operation of servers and data centres, which are the places where data "on the internet" is stored and processed (e.g. Google mail, Facebook etc.). Data storage and processing at data centres is often referred to as "cloud computing" or "the cloud".

According to the Malmodin et al. (2010) study, the global electricity consumption related to the operation of data centres amounted to about 180 TWh in 2007, which corresponds to about 25% of the total operational electricity consumption related to ICT. If measured by GHG emissions, the operation of data centres represented about 17% of the global ICT-related emissions. Koomey (2011) estimates that electricity used in global data centres in 2010 represented about 1.1%-1.5% of the total, global electricity use.

Seetharam et al. (2010) estimates that the average energy consumption for data centres (data storage and servers) related to the streaming of a 7.5 GB movie is about 0.755 MJ or 0.2 kWh; or, if measured per GB,

[5] Not included are 1) the energy consumed by the smart phone itself and 2) energy consumption related to data centers and the overall internet infrastructure (except the cellular/mobile broadband network).

about 0,03 kWh/GB. This includes direct power consumption as well as operating and overhead costs (e.g. cooling) and embodied energy for the manufacturing of the servers at the data centre. Compared to the energy costs related to data transmission presented previously (0.2 kWh/GB), the energy costs of data centres seem to be somewhat lower than related to the data transmission.

3.6 Second order effects (dematerializing consumption)

Obviously, ICTs hold potentials for dematerialising different consumption areas. The prospect that has got most attention hitherto is the potential of substituting physical face-to-face meetings by ICT-mediated interaction (in the literature often referred to as "tele-presence"). As a result, the need for physical transport would be reduced and thereby save energy. However, this potential for dematerialisation has until know not been realized, and some studies indicate that the increased use of ICT (especially the internet) for communicating with increasingly larger networks of people actually might contribute to an increase in (physical) transport as ICT-mediated interaction is often follow-up or supplemented by face-to-face meetings. This is an example of the second-order effects called *induction* (presented previously), which can counterbalance the energy saving potentials related to dematerialization.

An example of a study of the potential of using ICT to dematerialise other consumption areas is the study of Weber et al. (2010) on the energy and climate implications of substituting traditional compact disc (CD) music delivering by digital download services (i.e. digital download of music albums). This study found that digital music purchase reduces the energy and CO_2 emissions by 40-80% compared to the best-case physical CD delivery. This exemplifies how ICT can hold significant potentials for reducing the energy consumption of other consumption areas. However, this particular study is already somewhat "outdated" as the main focus of it was on download of digital music albums (which was a dominant form for internet-based, digital music listening at the time of study), whereas it seems as music streaming has become much more widespread form of digital music listening today. Compared to downloading music files, music streaming might over time involve considerable higher volumes of internet data traffic, which in turn can increase the energy consumption for music data transmission over the internet. The best case digital music purchase scenario in Weber et al. (2010) resulted in an energy consumption of 7 MJ/album – or about an energy saving of about 46 MJ/album compared to the worst case scenario for purchase of physical disks. 46 MJ corresponds to 13 kWh. If the length of a music album is assumed to be about 1 hour, each audio streaming of one entire album would amount to about 0.009 kWh (figures above). Thus, it would be possible to play an album the following number of times, before the increase in the internet data transmission outweighs the saved energy consumption from replacing a physical CD by digital music listening: 13/0.009 = 1,444 times. This is a rather high figure, which indicates that rebound effect in this case will probably not entirely outbalance the gains from shifting from a physical to a digital medium.

A similar study, but focusing on streaming movies over the internet compared to mailing DVDs to customers (on a rental base; i.e. that the DVDs are later returned), has been carried out by Seetharam et al. (2010). The study shows that if comparing the total energy consumed and the carbon footprint impact of the two different delivery methods, "the non-energy optimized streaming of a movie through the internet consumes approximately 78% of the energy needed to ship a movie, but has a carbon footprint that is approximately 100% higher." (p. 61). However, the authors point out that the carbon footprint could be lowered significantly if more energy-efficient technologies were applied for the serving and transmission of the movie (estimated 30% reduction of energy consumption and 65% reduction of carbon footprint). The energy consumption for streaming services is highly dependent on the amount of data transmitted (i.e. the quality-level of the streamed video-content), as also showed above. Seetharam et al. (2010) also find that the potential energy reductions from shifting from mail shipping to streaming are potentially counterbalanced if

the longer term trend involves higher video quality (e.g. 3D high-definition movies). Again, this shows how closely the prospects of ICT for dematerialising consumption is closely related to (and dependent) on future trends in the consumption of ICT services. Thus, the energy saving potentials of video streaming might be eaten up by increasing amount of data transmission. Or in the words of Seetharam et al. (2010): "this work reminds us that IT – even greened IT – is not always a panacea for significantly 'greening' traditional industries, despite the rather intuitive appeal of delivering data via a gleaming, modern IT infrastructure versus a traditional bricks, mortar, and roadway system." (p. 61).

Another example of studies of environmental impacts related to different ICT-related activities is a study by Farrant & Guern (2012) on electronic mail (which can be seen as an alternative to previous ways of communication, particularly postal mails). The study is a "full LCA" of the environmental impact related to sending and receiving e-mails (including the manufacturing, the use and the end-of-life of all equipment needed to send/receive e-mails, including computers, servers, routers etc.), and it shows that sending a 1 MB e-mail results in about 0,477 MJ primary energy consumption (or about 0.13 kWh/1 MB). The study also shows that the environmental impacts (including energy consumption) are primarily related to the manufacturing of the equipment on the sender/receiver side (computers, routers etc.) and for power consumption related to data centres (mainly storage). Thus, about 57% of the total energy consumption relates to sender/receiver side and about 42% to data centres.

3.7 Concluding on energy-intensive ICT practices

On the basis of the literature survey presented in this section, the following practices or habits in relation to the use of ICT can be identified as particularly energy-intensive – and therefore important to keep in focus in the useITsmartly project:

- Use of desktops ("stationary computers") involves high power consumption for the use (operation) phase.
- Frequent renewal of ICTs results in high energy (and resource/material) consumption for manufacturing as well as problems with electronic waste
- Use of internet services that involve high volumes of data traffic (down- or upload) result in high internet-related energy consumption (particularly for data transmission). This is typically streaming or downloads of movies and video clips (Netflix, YouTube, movie download via file sharing etc.) or similar data-intensive activities like online game playing. In addition, these activities also typically involve high power consumption for processing graphics on the user's device.
- The habit of *not* turning off computers (desktops/laptops) and leaving them in standby/sleep mode (hibernate) contributes to significant standby energy consumption in households.
- Using *mobile broadband* access connections instead of wi-fi on mobile devices results in high power consumption for data transmission (especially if used for data-intensive downloading/streaming such as viewing YouTube or Netflix "on the move").
- The general trend of increasing data traffic (in the everyday life of young people represented by, for instance, more and more download/streaming of audio-visual content) results in a general increase in energy consumption for internet infrastructure (network and data centres).
- Buying more devices results in increasing energy (and resource/material) consumption for manufacturing as well as handling electronic waste.
- Watching television is a particular energy-intensive ICT activity
- ICT holds different dematerialisation potentials (e.g. replacing "paper reading" by e-reading).

With this in mind, it is interesting to explore these energy-intensive ICT practices and the reasons for them in more detail. Later chapters elaborate on a number of these practices on the basis of the outcome of the focus groups.

4. Residential electricity consumption for ICT – comparing five countries

This chapter presents a review of previous studies on energy consumption related to the use of ICT in households. The review covers the five countries involved in the useITsmartly project. But first, we will give a general overview of the residential electricity consumption in the five countries, which represents the background for estimating energy saving potentials related to ICT usage.

4.1 Residential electricity consumption

The table below shows key figures on final electricity consumption in the five countries involved in this study.

	Austria	**Germany**	**Netherlands**	**Norway**	**Denmark**
Total final electricity consumption 2011 – all sectors (TWh)	61.534	521.512	107.473	105.403	31.389
Residential final electricity consumption 2011 (TWh)	17.817	136.594	23.690	35.437	10.106
Residential sector 2011 (share of total final electricity consumption, %)	29.0%	26.2%	20.0%	33.6%	32.2%
Average electricity consumption per dwelling 2011 (kWh/dwelling)	4,881	3,378	3,183	16,095	3,910

Table 1: Key figures on residential electricity consumption

References: Eurostat (2013) on final electricity consumption (total and residential). Average electricity consumption per dwelling calculated from residential electricity consumption 2011 divided by number of households. Data on number of households from: Statistics Austria (2013); Statistisches Bundesamt (2013); Statistics Netherlands (2013); Statistics Norway (2013); Statistics Denmark (2013).

Table 1 shows great differences in the 2011 total and residential final electricity consumption between the five countries. Obviously, the primary reason for these differences is related to differences in population sizes. However, the table also shows significant differences with regard to the average electricity consumption per dwelling. Here, Norway stands out with average electricity consumption per dwelling about four times higher than in the other countries. The main reason for this is the widespread use of electricity for heating Norwegian homes. For historical reasons and because of the availability of abundant and (relatively) inexpensive hydro power resources, about three quarters of the residential electricity consumption in Norway is related to heating (space and water). In the other four countries, the share of residential electricity consumption related to heating is much lower – in Denmark, for instance, only about 18% of the electricity consumption is related to heating (Christensen et al. 2013). It is estimated that the electricity consumption for appliances in Norwegian homes (i.e. residential electricity consumption except water and space heating) is about 4,500 kWh/year (Magnussen 2013).

Table 1 also shows considerable differences between the countries with regard to the residential sector's share of the total, final electricity consumption. Thus, only 20% of the electricity consumption is related to households in the Netherlands, while the household sector represents almost 34% of the total consumption in

Norway. Again, the major reason for the relatively high figure for Norway is that electricity is used for heating of houses and water in most Norwegian homes.

The high share of renewable (primarily hydro power) in the Norwegian energy mix makes the carbon footprint of Norwegian electricity consumption very low compared to the other countries. This makes talk about carbon footprints somewhat complicated in the Norwegian case, as many Norwegians (correctly) think that the carbon footprint of their personal electricity consumption is little. This also came up in the Norwegian focus groups (see later presentation of the focus group results).

4.2 Residential electricity consumption by final uses – with a particular focus on ICT

A review of previous studies of residential electricity consumption by final uses (lighting, cooking, heating etc.) was carried out in each of the five countries. The following table gives an overview of the results from selected studies (one for each country). In some of the countries, two or more studies have been identified. In these cases, we have selected the study which appears to have the highest reliability (typically because they are based on the largest sample). However, some more details on the other reviewed studies are presented later with some comments on the differences and similarities.

	Austria[1]	**Germany**[2]	**Netherlands**[3]	**Norway**[4]	**Denmark**[5]
Year (data collection)	2012	2007-2011	2011	2011	2012
Lighting	**11%**	**9%**	**14%**	**21%**	**10%**
Heating, cooking & white goods	**67%**	**53%**	**56%**	**50%**	**56%**
Cooking	10%	10%	5%	13%	9%
Heating (space & water)	28%	13%	16%	-	21%
Air conditioning	4%	-	-		-
Ventilation	-	-	5%		-
Fridge/freezer	12%	16%	15%	23%	11%
Washing machine & dryer	7%	} 14%	11%	14%	} 15%
Dishwasher	6%		4%		
IT & Electronics	**9%**	**25%**	**19%**	**23%**	**33%**
TV	} 6%	-	7%	9%	-
Video & Audio		-	5%	5%	-
IT (PCs, laptops etc.)	3%	-	7%	9%	-
Miscellaneous	**14%**	**14%**	**10%**	**6%**	**1%**
Source	*(Statistik Austria 2013)*	*(HEA 2012)*	*(ECN 2012)*	*(Xrgia 2011)*	*(ELMODEL-Bolig 2014)*

Table 2: Residential electricity consumption (households) by final uses

[1] Theoretical model. Results based on survey results (650 households asked about their stock and use of appliances) combined with data on energy consumption of types of devices. It should be noticed that only 40% (263) of the households answered all survey questions, which makes the sample relatively small and the results should be interpreted with care. Air conditioning also includes additional heating devices, ventilators etc. IT also includes "communication devices".

[2] Based on analysis of 247.085 data sets of household energy check of the ErnergieAgentur.NRW. The data comes from a free, self-assessment online tool. URL: http://www.ganz-einfach-energiesparen.de/. As it is self-reported data, there might be biases related to these figures. Miscellaneous includes air-conditioning.

[3] Study based on actual metering data on energy use.

[4] Theoretical model. Results based on survey data (2,000 households asked about their stock and use of appliances) combined with data on energy consumption of types of devices. Notice: Electricity consumption for heating *is not* included in this study. The figure on Video & Audio also includes game consoles and set top-boxes.

[5] Theoretical model (ELMODEL-Bolig). Results based on survey data (app. 2,000 households asked about their stock and use of appliance – the survey is carried out every second year, last time in 2012) combined with data on energy consumption of types of devices. The category "IT & Electronics" (in ELMODEL-Bolig termed "Entertainment")

includes: TV sets, computers, video/bluray/DVD players, set-top boxes, stereo & sound surround systems, printers, scanners, routers, external hard disks, game consoles and other miscellaneous ICT. Part of the standby is included in the IT & electronics group. According to Energistyrelsen (2012), standby consumption represented about 9% of the total electricity consumption in Danish households in 2010 (and a considerable part of this might be assumed to be related to IT & Electronics).

As table 2 shows, there are differences between the distributions among the five countries. This is not surprising in itself, as differences might be assumed for particularly three reasons: *First of all*, some uncertainty is related to all the referred studies of the distribution of final electricity consumption in households. The results based on theoretical models, for instance, involves uncertainties in relation to the surveys of people's ownership of appliances as well as their self-reported estimates of how much time they use each of these devices (as well as estimates of how much time their appliances run on standby etc.). Also, the estimates of the power consumption of different (groups) of devices such as tumble dryers, dishwashers etc. are associated with uncertainties due to general assumptions etc. *Secondly*, the different studies also often apply slightly different definitions of the different categories of final uses. For instance, some studies work with aggregated categories like IT & Electronics (e.g. German study referred in table 2), while others work with more disaggregated categories like TV/Video/Audio and IT, respectively (e.g. the Austrian study). Similarly, ventilation is identified as a separate category in the Dutch study, whereas the electricity consumption related to ventilation is included in other categories for all other studies. Another important – and specific – difference relates to the Norwegian study, as this study (as the only one) does not include electricity related to heating. The reason for this is that electric heating is very widespread in Norway and overall represents about 75% of the total residential electricity consumption. If heating was included, the figures for all other consumption categories would therefore be much lower (which would make it difficult to compare the Norwegian figures with the other countries). However, as the other countries include electricity for heating, there will be a general tendency that the figures for all other consumption categories than heating might appear slightly lower for the other countries compared to the Norwegian. For the same reason, the table below (table 3) represents the distribution by final uses if heating is excluded. *Thirdly*, differences between countries might refer to "real" differences in the distribution of residential electricity consumption by final uses. For instance, the share of electricity for lighting might vary due to differences between countries in the distribution of daylight over the year (depending on the latitude), differences in everyday life patterns (e.g. how much time people stay at home in late afternoon/evenings), differences in light appliances used as well as differences in understandings of what a "nice and cosy" home is (and the implications of this for the electricity consumption for lighting). Similar explanations might be found for differences in relation to other categories of final uses.

	Austria	Germany	Netherlands	Norway	Denmark
Year (data collection)	2012	2007-2011	2011	2011	2012
Lighting	**15%**	**10%**	**17%**	**21%**	**12%**
Cooking & white goods	**54%**	**46%**	**48%**	**50%**	**44%**
Cooking	14%	11%	6%	13%	11%
Air conditioning	6%				-
Ventilation	-		6%		-
Fridge/freezer	17%	18%	18%	23%	14%
Washing machine & dryer	10%	} 16%	13%	14%	} 19%
Dishwasher	8%		5%	-	
IT & Electronics	**13%**	**29%**	**23%**	**23%**	**42%**
TV	} 8%	-	8%	9%	-
Video & Audio		-	6%	5%	-
IT (PCs, laptops etc.)	4%	-	8%	9%	-
Miscellaneous	**19%**	**16%**	**12%**	**6%**	**2%**
Source	*(Statistik Austria 2013)*	*(HEA 2012)*	*(ECN 2012)*	*(Xrgia 2011)*	*(ELMODEL-Bolig 2014)*

Table 3: Residential electricity consumption (households) by final uses (heating not included)

Table 3 shows differences for all overall categories of final uses (lighting, cooling/white goods, IT & electronics and miscellaneous). With regard to miscellaneous, these differences might in particular be related to methodological differences with regard to what is included in this residual category. For instance, the German study includes air-conditioning in this category, while it is calculated separately in the Austrian study.

For most countries, *lighting* represents about 10-15% of the total electricity consumption. However, Norway (and to some degree also Netherlands) seems to have a higher electricity consumption for lighting. That the share related to lighting is relatively high in Norway is supported by the results of the REMODECE study. This study was based on metering data of appliances in 100 Norwegian households, and the results were weighted relative to the composition of households in Norway. In this way, this study differs from the study referred in table 2 and 3, as this study is based on actual metering data and not model-based data. Still, the REMODECE study results in similarly high figures for the electricity consumption associated with lighting: 29% (if heating is excluded). (SINTEF 2012)

With regard to *cooking and white goods*, the figures also vary somewhat with Denmark having the lowest share (42%) and Austria having the highest (54%). The high Austrian figure might partly be due to methodological reasons as the Austrian figure on air-conditioning also includes "additional heating devices", which might in the other studies be part of the category of heating. However, despite some differences between the countries, table 3 draws the overall picture that about half of the households' electricity consumption (heating excluded) relates to cooking and white goods.

With the exception of Austria and Denmark, the overall category of *IT & Electronics* shows relative high consistency across the countries with about one-quarter of the total electricity consumption (heating excluded) being related to the use of IT and electronics (the latter including entertainment devices). Thus, IT & electronics today consume significant more energy than lighting (a category that has historically been in particular focus with regard to energy saving) as well as IT & Electronics is today consuming more electricity than cloth and dish washing together. On the disaggregated level, table 3 shows that TV sets and IT-related equipment (PCs, laptops etc.) represent the main part (more than two-thirds) of the electricity consumption related to IT & Electronics.

The Austrian results for ICT-related consumption differ markedly from the other countries by being much lower. However, as mentioned in the notes of Table 2, the Austrian study is based on a survey with relatively few respondents. Thus, the difference might be related to the uncertainties of the study. The main reason for the high figure on ICT-related consumption for Denmark seems to be that much of the electricity consumption related to smaller devices has been allocated to the category of IT & electronics (hence the low figure for Miscellaneous). For the other countries, the category Miscellaneous seems to include many smaller devices like TV peripherals etc.

In the following, we conclude this chapter with a short summary of the other studies on the distribution of residential electricity consumption on final uses that was identified in the national reviews (and not included in table 2 and 3).

Austria

The figures in table 2 and 3 are based on the only study on the distribution of residential electricity consumption by final uses identified in Austria (Statistik Austria 2013). At the time of writing, another project called HOME-ICT is carried out by Austrian Energy Agency and Institute of Telecommunications at Vienna University of Technology. Methodology, this project also works with modelling of private end-use consumption for households (similar Statistik Austria 2013). The study also includes scenarios for the further development in ICT-related energy consumption. These scenarios indicate that an increase in IT-related energy consumption is expected in the future, but increasing energy efficiency of devices can help reduce the increase in energy consumption. (Austrian Energy Agency 2013).

Germany

The German review did not identify other detailed and reliable studies on the distribution of households' electricity consumption by final uses other than the study referred in Table 2 and 3. However, the Federal Statistical Office published in 2012 some overall statistics on the energy consumption of private households. This shows that in 2012, 40% of the total electricity consumption was related to the category "Electrical equipment" (which is a rather broad category including all other consumptions than electricity for heating purposes, cooking/drying/ironing and lighting).

In addition to the figures in Table 2, the study HEA 2012 also finds that the electricity consumption for TV, audio and office equipment (ICT) has gone up from about 7% in 1996 to about 25% in 2011.

A 2009 study by Fraunhofer Institute gives a detailed picture of the ICT-related energy consumption by different types of devices (Fraunhofer Institute 2009). Even though this study is rather old, the detailed level gives some interesting insights into the composition of ICT-related energy consumption. Thus, the two main components of the electricity consumption are computers (in this study traditional, stationary PCs) and TV sets. TVs are estimated to represent 33% of the total ICT-related electricity consumption in German households (in 2007), while computers represent 21% of the total energy. These are followed by:

- Television-related devices (game-consoles, DVD/VHS and set-top boxes): 15%
- Computer-related devices (monitors, routers, scanners and printers): 14%
- Audio devices (music): 10%
- Telephone (traditional landline) and fax: 4%
- Mobile phones: 2%
- Notebook computers: 2%

The study also develops scenarios, which indicates that the total residential ICT-related electricity in Germany might increase by almost 25% from 2007 to 2020 if the development follows the trends at the time of the study (baseline scenario). The expected growth primarily takes place in relation to television and computers.

Netherlands

While the study referred to in Table 2 is based on actual metering data on households' electricity consumption, another study from 2007 (Clevers & Verweij 2007) estimated the of ICT-related electricity consumption on basis of a theoretical (calculation) model, which – like most of the other model-based studies – combines data on households' ownership and usage time of different device categories with data on average power consumption of devices included in these categories. The study found that 24% of households' electricity consumption in the Netherlands is related to ICT. This figure is somewhat higher than the estimate in the study referred in Table 2 (19%). However, some of the difference might be a result of the Clevers & Verweij-study also including control equipment for central heating and security. Another partially model-based study is the *Energie in Nederland* study carried out by *Netbeheer Nederland* (Energie Nederland 2011). The study is based on annual electricity consumption (actual meter readings) and surveys on possession of appliances of about 3,000 households. A model is used to calculate the distribution of residential electricity consumption by final uses. The study shows that the electricity consumption related to audio, video and communication represents about 15% of the residential electricity consumption (2010-figure) or – in absolute measures – about 506 kWh/household/year. The ICT-related electricity consumption has the same size of magnitude as the electricity consumption of lighting as well as heating and hot water. Thus, the three Dutch studies identified find different values for the share of residential electricity consumption related to ICT ranging between 15% and 24%.

The 2007 study (Clevers & Verweij 2007) finds that almost half of the ICT-related electricity consumption is related to entertainment (42%), which includes TVs and other video and audio appliances, while the second largest subcategory is data processing (39%), which includes computers and related devices. The third largest subcategory is infrastructure (13%), which includes receivers (digital TV etc.), modems, routers and control equipment for intelligent home. Finally, communication (mobile phones and wireless communication) represents only 4% and intelligent home (control equipment for central heating and security) represents 2%.

The study also presents estimates of the electricity consumption for different types of households: households with children, households above 65 years (without children), one-person households and multiple-person households. In relation to the useITsmartly study, the results for households with children are the most interesting. In 2007, there were about 2.5 million households with children, and the average IT-related electricity consumption for this type of households was about 870 kWh/household/year in 2007. Like for the Dutch households in general, the main part of this electricity consumption is related to entertainment (42%) and data processing (39%). In comparison, the average IT-related electricity consumptions for the other types of households were: 384 kWh/household for households with elderly (65 years and above), 694 kWh/household for the group of "other one person households" and 1130 kWh/household for "other multi-person households". As can be seen, households with children are having more than the double IT-related electricity consumption than households with elderly people and about a 25% higher average electricity consumption than one-person households. While interpreting these figures, it is important to have in mind that the study is from 2007 and that the absolute consumption as well as the relative figures might well have changed somewhat due to changes in the composition of ICT devices and how they are used.

Finally, a newer study from Utrecht University (Tselekis 2011) estimates that about 8% of the total electricity consumption in the Netherlands is related to appliances on standby. Most of this is related to entertainment (57%) and ICT (34%), whereas cooking equipment accounts for 7% and miscellaneous equipment for 2%. However, some uncertainty might be related to these figures, as the study was based on a relatively small sample of 44 households.

Norway

The Norwegian figures in table 2 and 3 are based on the most recent study of the distribution of residential electricity consumption by final uses (Xrgia 2011). An older study was the previously mentioned REMODECE study carried out by SINTEF in 2009 (SINTEF 2012). On the basis of actual metering of the electricity consumption of appliances in 100 households (weighted relative to the composition of households), this study found the following distribution on final uses: 64% for room heating, 15% for hot water, 6% for lighting, 5% for refrigerator/freezers, 3% for laundry, 2% for kitchen appliances, 3% for electronics and 2% for computers etc. Thus, the REMODECE-study found that about 5% of the total residential electricity consumption was related to ICT. If space and water heating is excluded, ICT would represent about 24% of the other electricity consumption – i.e. more or less the same figure as found in the Xriga study.

The Xrgia-study also compares the electricity consumption of different household types. The comparison shows that households with children under 18 years living at home consume considerably more electricity than households with no children living at home. Washing and drying are especially distinctive as the group of appliances with the largest difference in consumption. On average, households with children living at home consume the double amount of electricity for this purpose compared to households without children living at home. Consumption related to other appliances also increases somewhat with the increasing age of the youngest member of the household, primarily with regard to TV and computer equipment, but also refrigerators and freezers.

Thus, the Xrgia study shows that it is households with children living at home that use most electricity (relatively). Families with the youngest family member being a teenager consume the most (about 5,000 kWh/household/year; electricity consumption for water and space heating not included), while families with the youngest member under five years use slightly less (about 4,800 kWh/household/year). However, the main difference between households with children versus households without children is not related to the electricity consumption of ICT, but is related to cooling & freezing, cooking, washing & drying and lighting.

Denmark

The Danish model ELMODEL-bolig is an extensive software model that can be used to calculate total electricity consumption in Danish households by different types of appliances (the model includes about 30 different types of appliances). The figures in Table 2 and 3 for Denmark are based on this model. As ELMODEL-bolig also includes historical data about the stock of appliances in Danish households and the average time of use per appliance, it is possible to calculate the historical development in the distribution of the Danish households' electricity consumption by final uses since 1946. Figure 1 shows the development from 1946 to 2006 as reported in Røpke et al. 2010. The results for 1974–2006 are estimated to have high validity, whereas the figures for 1946–1973 are more uncertain. However, as this report focuses on electricity consumption related to ICT, this does not affect the overall picture shown in Figure 1, since the real take-off of new ICTs did not occur before the late 1980s and early 1990s. Also, it should be noted that the category ''Miscellaneous'' includes many different small appliances, including ICTs like printers, routers etc. (these were later included in the category of IT & Electronics, cf. Table 2 and 3 above).

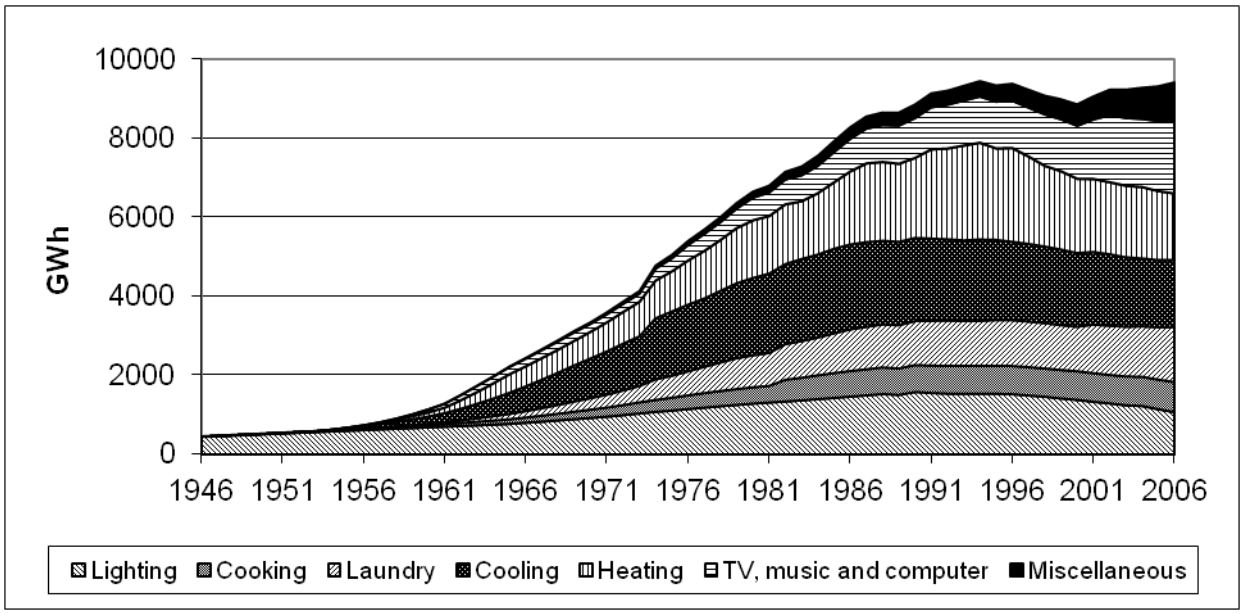


Figure 1: Danish household electricity consumption (GWh) distributed by final use 1946-2006. Source: Røpke et al. 2010.

As Figure 1 shows, the share of electricity consumption related to ICT was relatively small up to the mid-1970s, where the electricity consumption began to accelerate. The figure also shows that if it had not been for the marked increase in TV, music & computer as well as Miscellaneous (which also includes several ICTs), the total final electricity consumption of the Danish households would actually has decreased significantly since the mid-1990s. In this way, the growth in use of ICTs has been a major contribution to outweighing the increased energy efficiency of other consumption areas (in particular heating, cooling and lighting).

The study reported in Røpke et al. (2010) also showed that TV, video and stereo represented about 12% of the households' total electricity consumption in 2006, while PCs represented about 8%. As the figures in Table 2 show, the share of residential electricity consumption related to ICT has increased further since 2006 and now represents about one-third of the total electricity consumption.

An older study based on actual metering data for 100 households (carried out in 1999/2000 and reported in Gram-Hanssen 2005) showed that ICT (at that time) represented about 10% of the total electricity consumption in the households (6% for TV, video and stereo; 4% for PCs). In addition, standby represented 9% (of which the major part is related to ICTs). The study also showed great variations between the households. For the electricity consumption related to TV, video and computers, the study found no clear relation with income or age, whereas there was identified a relation with the number of devices and how often they were used. The number of devices was in particular related to when the children of the households got their own TV and computer. Thus, households with children with their own TV and/or computer had higher electricity consumption for ICT in general.

5. The role of ICT in young people's everyday life

5.1 Introduction

This chapter presents the results of a literature review on ICT user practices of young people. The ICT category includes both IT and consumer electronics (including entertainment, MP3 players, music, video etc.).

As the available literature on this topic is limited, we do not attempt to provide a comprehensive cross-disciplinary or cross-cultural overview of what different disciplines have investigated and reported on the interaction between ICT and young people. Instead, we will provide a first start at understanding how, when, where, why, with whom and how frequently young people use ICT. Subsequently, based on this review, we identify "entry points" for interventions that can help shape a more sustainable ICT use among this particular group.

Although evidence suggests that one teenager in a household entails a 20% higher electricity consumption compared to an average adult (Gram-Hanssen (2005), literature on the topic of young people and energy use is to date very limited. And although there is much information on adoption rates for devices etc. per country, little is known about the adoption of ICT by *young* people and in particular little understanding is available on why young people use certain ICT the way they do or.

We searched for articles and findings focusing on the age group 16-20 years old, the target group for our useITsmartly project. However, since there is not a lot of material on this age group, we decided to extend the age margins to also include children ranging from 12-13 years old. We acknowledge that this is to some extent problematic, especially when addressing gender-related dimensions. Children at the age of 12-15 are in puberty and might be particularly seeking for their gender identities, while the situation for 16-20 years-old might be very different.

The following sections focus on the different characteristics of ICT use: the meaning of the use (Why), the user profiles (male, female, socio-cultural and socio-demographic aspects), the frequency (how often), the location or events (When and Where), the social and normative aspects (with whom, particular lifestyles, in relation to identity matters, social norms), the different ways of using (how and for what), the means (which ICT for which goal?) and potential entry points (why would they change their practices, in response to whom or what?).

Not only is the literature limited, ICT itself is changing rapidly – e.g. the strong proliferation of smart phones and the increasing popularity of the social media application for smart phones WhatsApp are new developments that are not addressed in the studies reviewed. However, in terms of practices that involve ICT, conclusions are still relevant – as will be showed in the later presentation of the focus groups findings.

We present these findings as interesting starting points for further analysis and research, while at the same time acknowledging that the picture painted is necessarily limited at certain points. However, combined with the findings from the focus groups and the previous technology trend analysis, we believe that this will help qualify the designing of relevant interventions targeting young people and their ICT knowledge, practices and attitudes in the useITsmartly project.

5.2 How relevant is gender for ICT use?

Different studies have investigated if there are gender differences in the type of ICT being used or the way the ICT is being used. Gross (2004) for example found that although there are many expectations concerning

gender and ICT, many of these expectations appear unfounded. The first stereotype that she unravelled in a study involving 261 children ranging from 12 to 15 years old, was that boys would spend more time online, surfing and playing (violent) games while girls would be more prone to activities online such as shopping and chatting. The study revealed that boys and girls are much more alike than expected in their online activities. The wide variety of applications for online interaction has broken down the gender differences that still existed when games were among the few popular computer uses in the early years of ICT mass commoditization. At that time, it was mainly boys that interacted with computers, mainly because they wanted to play games, while girls were less interested. However, Gross found that a small minority of boys (5%) did spend considerably more time online playing games than the rest of the sample.

Based on focus group research, Brito (2012) also found no gender dependence in the ways 103 Portuguese tweens (teenagers in transition – in between – aged 12-13) used ICT except for gaming. ”To play” was an attribute of digital technologies mentioned much more often by boys than girls. Some patterns could be discerned in Brito’s (2012) research. With a peak at age 15, introvert and non-socially anxious girls tend to use more interaction-based activities when online.

Gram-Hanssen (2005) interviewed several Danish teenagers and also found a small difference in use of computers between boys and girls. Although the interviewed teenagers all used the computer to collect information on sports, music and other interests, girls also used the computer for chatting and creating personal profiles.

The above findings suggest that there is a diminishing gender divide due to the wide variety of ICT applications, with the exception that boys are more likely to be dedicated players of certain online games. For our project this could result in a recommendation that we do not need to be particularly sensitive to segmentation in terms of boys or girls, except potentially when dealing with gaming. A segmentation based on practices and meanings attributed to certain ICT applications and uses might be more fruitful.

5.3 Why energy is used

As it is important to reduce the electricity consumption from ICT use, it is necessary to understand how young people think about energy-related aspects of their ICT use. Toth et al. (2013) discusses citations from young participants that clearly demonstrated the integral part ICT played in the life and lifestyle of these teenagers, and what that means for the prospects of reducing related energy consumption. An example of a statement is: ”without energy we wouldn't be able to do like hardly anything. Nothing at all” (junior teenager, female) (Toth et al. 2013, p. 39). Changing this lifestyle and consuming less energy with their ICT are consequently seen as something that is difficult to do for teenagers: ”It’s a good idea but it’s a bit of a pain”(senior teenager, female) (Toth et al. 2013, p. 42). There are several other aspects seemingly playing more important roles for young people, in terms of their ICT use, which is elaborated in the following.

Choice of ICT

In the focus groups with 103 Portuguese “tweens” (aged 12-13), Brito (2012, p. 7) found that the choice for a particular online interaction channel (email, phone, sms, instant messaging) depended on several things, amongst others how instant the reply was wished for: ”when we send an email it takes too long a time to get feedback”; or it is related to the length of the message to be sent: “The SMS are really short and have a limited space. Sometimes we have to send two messages”. And when tweens want to discuss private matters, written accounts are often not a good idea, as these can be read later by others or maybe forwarded to others. Therefore, if communicating about private matters via voice calls, ”nobody can read it later if they forget to delete”.

Brito's tweens attributed several characteristics to different digital technologies or tools. In order of frequency of reporting, tweens reported SMS to be an easy way to communicate (92%), to share files (54%), to communicate with family and friends (app. 30%), but also listed that the messages usually were short and cheap. SMS was mainly seen in a utilitarian manner. Instant messaging shares the first two attributes but with a lower percentage of tweens attributing these characteristics than with SMS. Different to SMS is that instant messaging was found to allow the sharing and seeing of messages with others, and thus also getting to know others and was attributed the characteristic of playing.

To conclude, it seems that choice of ICT depends on what it is used for, what sort of interaction it supports (e.g. personal conversation, quick and brief exchanges, speed, ease, price, number of participants, openness to others to participate).

Gram-Hanssen (2005) found that for the Danish teenagers she interviewed, having a mobile phone with many functions was important, especially for the boys. Having a camera on the phone, and being able to send and receive photos, and the ability to use email were very important at the time of the study (2005). Gram-Hanssen however found that teenagers' user practices (i.e. *how* they use ICT) seemed to vary much more than their ICT possessions (i.e. *what* ICT devices they have).

Safety and security

In one study amongst young Australians aged 16-22 (Caroll et al. 2002), safety and security was often listed as the first reason to buy a phone or for parents to purchase one for their teenager. This could, however, be a socially desirable answer that followed a certain line of questioning. And in the course of time, this reason seems to have lost much of its importance with the increased diffusion and the normalisation of having a mobile phone. The study by Caroll et al. also showed that the mobile phone did create a sense of security for both girls (being able to call if in trouble) and for boys (being able to arrange a ride home if too drunk or too late).

Social aspects

The question how ICT has become an integral part of the life of young people or what meaning ICT has or brings to young people is fairly consistent in different studies: most studies state the use of ICT that deals with online interactions by teenagers is mostly about creating meaningful social interactions and strengthening or creating a sense of belonging. However, some studies have also revealed the darker side of the coin, since it is thus also a powerful tool to exclude certain people from a group or create a we/them divide.

Gross (2004) found that boys' and girls' online interaction take place in "private settings" such as email and instant messages, and involve interaction with people they have interactions with offline in daily life and that these interactions are devoted to ordinary, yet intimate, topics. Online pretending was not found to be a motivation for the use of ICT and online activities, unless it was aimed at joking with friends. The means used and frequency of use for this social interaction can however differ between different countries and age groups. Gross (2004) found that the older the children, the less SMS, instant messaging and e-mail or chat are used for gossip.

Gross (2004) reports that early studies reported that a lot of online time could have a negative impact on wellbeing because of isolation issues. In her study, Gross found no such detrimental impact. Young people used ICT to strengthen social ties. This finding was also found by Van Abeele & Roe (2011) for another group of young people: freshmen in Belgium and the USA. They found that, interestingly enough, Belgian freshmen used their mobile, email and instant messaging to keep in touch with the home front when they

went off to college, and the USA college students used these ICT channels to create social relations with new friends. Also, Brito (2012) reports that strengthening social ties with friends and family through online interactions increases the wellbeing of young people, while online interaction with strangers does not.

The essential characteristic of the mobile phone as a tool for building or strengthening social ties and thus being essential for the social life of young people was found in multiple studies (Abeele & Roe 2011; Caroll 2002; Brito 2012; Gross 2004). The following citations illustrate how a massive need for and impact of the mobile phone has evolved in teenagers' lives: "A mobile phone builds friendships because you can talk to them more… It's more personal because it is you being called, not your home." A mobile phone thus almost becomes a "prerequisite for a social life" (Caroll 2002, p. 5), and the phone becomes a life organiser : "it's my diary, I store everything in my phone, including numbers such as tax file numbers and bank accounts" (Caroll 2002, p. 5).

If owning a mobile phone increases the social ties and – in the eye of the teenagers – the quality (read: frequency and content) of those ties, not having a mobile phone creates exclusion: "Sometimes it's really hard, all my friends have one, my friends can't contact me" (Caroll 2002, p. 5).

However, the studies that state that the phone is used to increase the social ties however do not provide more information on the quality of these ties or question whether it is really about increasing the social ties.

Style and fashion were identified by Caroll et al. (2002) as important features of a phone, as one quote illustrates: "if you're going to spend money you want something that looks good" (p. 4). As long as accessories are available to pimp the phone, being a bit outdated was not seen as sufficient reason to opt for a new phone. However, if the phone is too old (e.g. one of the participants used a very old phone of his mother), then fashion and style is reason to want to buy a new phone due to the feeling or fear of being excluded from the dominant social norm. Also, Gram-Hanssen (2005) found that having a phone is essential, but owning the right one is at least as important. One of the teenagers she interviewed was embarrassed about his old phone and therefore did not bring it along. Having the right type of phone allows teenagers to take part in practices that are dominant in a certain group (e.g. exchanging photos or mails) and not being able to participate in those practices is what creates a sense of exclusion: "Yes you can be. I haven't tried it myself, but you somehow can sense it. When you are in the schoolyard and everybody is bleeping with their phones. Then if someone doesn't have a phone they can be a little unpopular, because you can't say to them. 'Look at this picture'" (Gram-Hanssen 2005, p. 12).

Caroll et al. (2002) found in their study that young people adopt ICT quickly when it neatly and seamlessly fits into their everyday life and does not require too many changes in their daily habits. Incremental changes such as SMS (texting), WhatsApp, Facebook, Grand Theft Auto etc. can be explained as fitting neatly and effortlessly in already existing practices.

Social status and ownership

The social status of ICT was also one of the topics investigated by Gram-Hanssen (2005). She found that all ICT technologies can give status if they are new and fancy. But there is a difference between how much status ICT can give. Some technologies such as TV, DVD players and play stations were not seen as status symbols. Having a big computer only really mattered to those teenagers who played a lot, but the joy of playing mattered more than the status of owning it. Gram-Hanssen (2005) found that access to the computer was more important than ownership, except for those teenagers that could be segmented as being "technophiles". Mobile phones, however, were downright status symbols, and owning was possibly more important than using it.

Empowerment

Digital technologies in general provided the tweens (aged 12-13) researched by Brito (2012) with a sense of empowerment; they felt that gaming increased their creativity or shaped their muscular response and internet increased their knowledge. Many technologies allowed the creation of a personal space through websites and blogs.

Another form in which this empowerment takes place is the use of digital technologies and the internet in particular to monitor and learn about health issues. Teenagers have identified social media and the internet as the main source for information about their health (Little et al. 2013).

Caroll et al. (2002) also found empowerment to be a crucial motivation for adopting the mobile phone for young people aged 16-22. The power and control to choose whether or not to respond to a call, assign different ringtones to different people and answering with SMS if talking is not wanted all contribute to a sense of control that the young people cherish.

Convenience and freedom

In addition, Caroll et al. (2002) found that the technological attribute of readiness-to-hand or convenience were the major attractiveness mentioned by the Australian young people in their research. Convenience ranging from being able to call from the bed to being able to speak to anyone at anytime and anywhere. Thus, the provision of freedom or independence of space and time was deemed crucial in the mass adoption of mobile phones by young people.

All interviewed Danish teenagers in the study by Gram-Hanssen (2005) had their own television set in their room, some already since they were aged 6 or 7. And many parents had given the teenagers the TV set because they felt it was a necessary thing to be able to watch different programmes. The freedom and convenience to be able to watch preferred programmes was thus a driver. Another aspect of freedom was that some teenagers had bought the TV with own money, or had been given the old TV when it was replaced by a newer model. Interestingly, having a TV in the room did not necessarily mean the teenagers chose to sit in their room to watch TV. Watching TV in the living room was for some considered to be cosier or more convenient because the TV was better and the furniture more comfortable or because only one TV set could use cable or satellite at a time.

5.4 Where and when energy is used

Toth et al. (2013) found that many children saw home as the main place where they used energy, and this had to do with the feeling of control children had over the use of energy. When it was their personal device that used energy, it was perceived as ”their” energy use. But if the energy was used collectively, e.g. at school (lighting or heating), they did not feel that it was them using the energy. Interestingly, the older teenagers (15+) saw home as the place where they consumed most energy, and did often not even mention school time . The younger children aged 10-14 years did more often mention school as an energy consuming place. A difference between weekdays and the weekend was mentioned, with the weekend day being more associated with energy consuming than weekdays (because of school time interfering).

5.5 How often and with what devices

Toth et al. (2013) found that older teenagers focused mainly on the electricity used by appliances and less on other types of energy use such as heating, water, transport and food. The use of more than one appliance simultaneously was recognized as a common practice of teenagers in several studies (Toth et al. 2013, Gross 2004). The reason for multitasking is captured in this citation of a 17-year-old female participant: ”I prefer to

communicate with my friends online because that way, I can talk to them while doing other stuff online. When you are talking to them in person or on the phone, it seems rude to be doing something else because they notice and you get distracted." (Gross 2004, p. 9).

Brito (2012) notes that why a certain device is chosen for a certain task and the intensity of its use in relation to social interaction cannot be explained by the characteristics of the device alone. The length of the relationship and its origin and distance as well as the communication content also form part of the framework needed to understand these choices.

Gram-Hanssen (2005) found that game consoles, video and DVD players were typically used a lot when new, but the use faded over time as the interest would fade. Computers were considered to be rather expensive and quickly outdated compared to other ICT equipment. At the same time, a good computer was seen as a necessity by many parents, mainly for homework purposes. Computers were indeed mainly used for homework, several hours a week (30 to 60 minutes a day). Gram-Hanssen (2005) furthermore found, in line with other studies cited in this report, that the mobile phone (and it needed to be the right type) was the ICT device most meaningful and most used by teenagers.

5.6 Entry points to start reflecting or rethinking the use of energy for ICT

In this final section we will discuss several of the possible entry points to motivate young people to reflect and rethink their energy use for ICT. The literature on this topic is very limited and more oriented towards climate or environmental education.

Who and what counts (reliable information sources)

In order to investigate how to potentially intervene with young people's ICT practices, it can be useful to know what kind of information that young people consider reliable in relation to their ICT activities and related energy consumption. Children in Toth et al.'s research listed advertisements, parents, sales people, grandparents and parent's friends as influential information sources. Older teenagers participating in the research described that schools, or more specifically teachers, were not seen as relevant information sources: "But in school you sort of don't really think about it that much, it's just oh that's what adults do I don't know" (senior teenager, female) (Toth et al. 2013, p. 39).

Peers were seen to be influential in relation to being "cool": "…it's like it's uncool to be eco-friendly sometimes" (junior teenager, female) (Toth et al. 2013, p. 42). Little et al. (2013) also found that teenagers are more influenced by their peers in comparison to younger adults and children. This indicate that peer to peer education can be very influential. Also, Caroll et al. (2002) found that friends and peers are the most powerful introducers of new technologies and accompanying practices.

Brito (2012) found that tweens (aged 12-13 years) think that the internet provides all the information they need, whilst at the same time assessing much of this information as unreliable. Confusion on reliability of internet information was mentioned to be an influential issue for teenagers in the research by Toth et al. (2013) as well.

Fielden (2011) made an important observation in her paper on the use of ICT to overcome barriers to behaviour change and implementing lifestyle interventions. She found that interventions to target childhood obesity highlighted the importance of parents and caregivers. If behavioural change techniques were also taught to parents and caregivers besides the children, the interventions showed much greater beneficial effects. Fielden (2011) states that to make full use of ICT to change behaviour, the intervention must be delivered into the home where both parents and children are decision makers in lifestyle choices.

Who Pays

Toth et al. (2013) found that if teenagers are not paying for the energy bill they are less likely to care or be concerned, expect for when they are "forced" to care because their parents care and remind them of their energy use at home. Costs were discussed to be a key issue in relation to energy use, but only relevant to them if they had to pay the bill themselves. They think that being "an adult" would make one more conscious about energy use because one would have to pay for it. However, the undergraduates in Toth et al.'s study only cared about energy use in relation to costs if their energy bill had to be paid separately and was not an integral part of the rent. Brito also found a relation between who pays and what type of ICT service is being used. If the young people have to pay themselves, they are more conscious about the financial consequences and, therefore, the choices of their ICT actions: "when I am short of money I send more SMS than use the mobile phone to talk" or "emails are costless" (Brito 2012, p. 6).

Gram-Hanssen found that among the interviewed teenagers, most parents did not want to buy expensive game consoles or video or DVD players because they had felt them to be too expensive. However, the teenagers then bought them with their own money or received them as presents. Electronics were generally considered one of the few possible Christmas or birthday presents for teenagers.

Who cares

Toth et al. (2013) also found that several teenagers felt detached to the problems related to energy use. When discussing the impact of their energy use, topics such as the environment (CO_2, ozon, gobal warming) were mentioned, but more as general facts than something to do with their behaviour.

Teenagers aged 15 are in full puberty and energy saving is definitely not a priority: "I think when you're… like 14, 15, 16 you already think your life's dramatic enough… to be bothered thinking about turning lights off and energy saving" (senior teenager, female); "….we're not going to be around when it (the climate /ed.) changes so" (senior teenager, female) (Toth et al. 2013, p. 42). In fact, in the useITsmartly project, we focus on young people that have passed this dramatic phase of full puberty hoping that they are more open to consider the impacts of their ICT practices.

Health related issues

Physical or health-related effects could be an entry point to start discussing the use of ICT and potential changes. Brito (2012) found that some of the tweens (aged 12-13 years) reported that their eyes hurt after too long a time behind a screen, or that cyber bullying and in particular online game addictions disturbed their achievements at school. However, the same sample of tweens reported that online gaming also increased and improved their muscle activity and body movement speed.

In the study by Caroll et al. (2002), many potential problems and issues were mentioned concerning the use of a mobile phone; from costs to brain cancer and limited reception or too small a phone for the hands of many. However, many of these young people mentioned that they either accepted the problems as inherent characteristics of the technology that they could not change or that they had learned how to work around them.

Caroll et al. (2002) demonstrate that once a mobile phone or any other ICT has been adopted and fits the life and lifestyle of a teenager, all actions undertaken by this teenager will reinforce and reinstate the need for the technology, creating in the end a life in which the technology is an essential and mundane element. It is therefore difficult to get young people to change their habits of using ICT.

5.7 Limitations of this quick scan

We used many different key words to conduct the literature review above, because the literature on this topic is at present still limited and fragmented. Many different disciplines investigate the ICT use of young people, e.g. development psychology, communication studies, sociology, but all with very different research questions and perspectives. In addition, although the useITsmartly project focuses on young people aged 16 to 20 years, the literature does not provide clear cut findings for that age group, and therefore we searched the literature with a less strict age boundary and also included studies involving younger age groups.

Cultural and economic context

Several studies did focus on socio-cultural context and comparative analysis. Brito (2012) refers to a study that found that in countries with similar economic development status, the ownership of digital media is similar, but the intensity and use differs. E.g. in Hong Kong, ownership was similar to Danish households, but the use of the ICT by tweens (aged 12-13 years) differed. In Asia, the main use was academic, in Europe the use was much more focused on entertainment and social interactions. However, the literature we investigated is so fragmented and often lacks contextual or cultural analysis that we cannot make any cultural comparative conclusions.

Methodological lessons

Several studies also provided insights into methodological issues when working with young people. To elicit young people to think about their energy consumption, Toth et al. (2013) for example used a mix of methodologies, including diaries that the teenagers had to fill in for seven days with short descriptions of what they did, what energy they used and where. In addition, the teenagers were invited to focus groups where drawing and storytelling were used as means to get the teenagers to talk about their energy use. Gross (2004) also stresses the importance of direct accounts, for example collected through diaries, as one of the best methodologies to learn about young people's usage patterns. Brito (2012) performed a focus group study with 103 students starting from the premise that young people often have much more information, beliefs and knowledge about benefits and drawbacks of different forms of ICT and the internet use than adults often think, and that before designing interventions to assist and educate children, a deeper understanding of what is already known and what beliefs the teenagers hold is important. Brito (2012) therefore goes one step further, stating that much research on teenagers and their ICT use is built on adult constructions of a digital youth. Therefore, according to Brito young people's own assessments in open and unstructured focus groups provided a more unfiltered, genuine understanding.

5.8 Conclusions

The findings discussed above clearly demonstrate that young people do not buy and use ICT because it performs specific and delimited tasks, but because they need it to support a lifestyle and more specifically their social life. Most ICT, and especially the phone, have often become essential and irreplaceable elements of their life, and quitting it is in their view comparable with quitting their social life. The challenge is to think of proposing/inviting them to changes that do not involve a "quitting-the-tech" and that do not ask them to abandon their identity and membership of a social group. This might seem daunting because technology and social life(styles) are in constant flux.

The conclusions below are a preliminary exploration of potential "to do's" and "not to do's" when developing interventions to get young people to make more sustainable use of their ICT:

1. For most children in full puberty, energy saving is definitely not a priority. This is also a reason for focusing in particular on the post-puberty young people (as in this project, where we focus on the 16-20 years-old).

2. To make full use of ICT to change user practices, the intervention must be delivered into the home where both (grand) parents and children are decision makers in lifestyle choices. Parents often support and facilitate the ICT use of their kids.

3. It is important not to underestimate the influence of parents on young people's adoption and use of ICT: For instance, ICT is often one of only a few (birthday/Christmas) teenager gift options for families, and duplicate ICT (TV, tablets etc.) provides convenience and individual independence to other family members as well (parents do no longer need to listen to their children watching TV, listening to music etc).

4. Young people's ICT user patterns seem to vary much more than their ICT possessions: do not be too sensitive to segmentation in terms of gender, except potentially when dealing with gaming. Segmentation based on the meaning and use of ICT applications might be more fruitful.

5. Be careful about the mobile phone. This ICT is very meaningful to most teenagers. Many ICTs, and especially the mobile phone, have often become essential and irreplaceable elements of teenagers' life, and quitting it would mean "quitting their social life" for them.

6. With regard to social interaction, young people's choice of ICT depends on what it is used for and what sort of interaction it supports (such as personal conversation, quick and brief exchanges, speed, ease, price, number of participants, openness to others to participate).

7. The use of ICT that deals with online interactions by teenagers is mostly about creating meaningful social interactions and strengthening or creating a sense of belonging, but can also involve elements of excluding certain people from a group or create a we/them divide.

8. Young people adopt ICT quickly when it neatly and seamlessly fits into their everyday life and does not require too many changes in their practices. Empowerment accompanying the adoption of certain ICT can be a crucial attractor.

9. Young people in general only feel a personal responsibility for energy consumption if it is related to their use of own devices.

10. Multitasking is widespread among young people.

11. Although ICT can be used to communicate with non-copresent others, many young people also use ICT together (copresence), e.g. playing games, exchanging stuff in the schoolyard, doing homework, streaming movies etc.

12. Friends and peers are the most powerful introducers of new technologies and accompanying practices.

13. If young people are not paying for the energy bill, they are less likely to care or be concerned.

14. Many young people feel that climate change and environmental and social problems are general ICT issues, not specifically related to their behaviour.

15. Many young people accept health risks or other ICT-related problems as inherent characteristics of the technology that they cannot change, or they learn how to work around them.

Part II: Young people's use of ICT and energy – outcome of focus groups

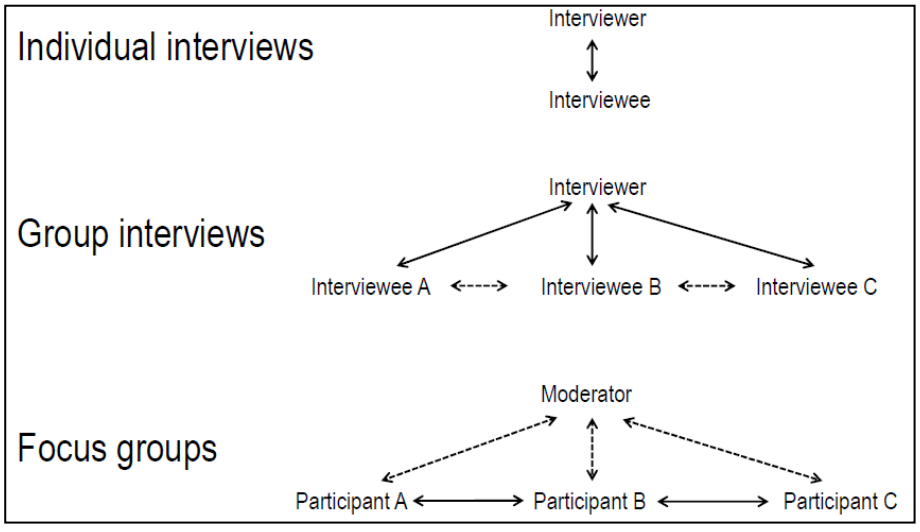
6. Method

As has been established, the energy consumption from residential ICT use is increasing, with complex environmental problems as a result. Therefore, the ICT consumption needs to be targeted, in order to bring down the related energy consumption. However, as has been explored in the above chapters, the use of residential ICT is deeply embedded in people's everyday life – particularly in young people's life. Targeting ICT use is therefore complex, as ICT use is related to multiple everyday life practices and therefore implicit, yet highly shaped through social interaction. Further, as has been established from the previous chapters, the energy consumption from ICT use is quite multifaceted as its' consequences can be described in terms of 1st, 2nd and 3rd order effects, making some of the effects very difficult for people to see and relate to on a daily basis. With that in mind, along with remembering that social interaction plays an essential role for particularly young people and their ICT use, researching young people's ICT use should be based on facilitating a discussion about ICT use. For this purpose, focus groups are an appropriate choice.

This chapter describes the method behind our focus groups, including how participants were recruited, focus group guide etc. The chapter ends with a short presentation of main characteristics of the participants in the focus groups.

6.1 Focus groups

Focus groups are different from individual interviewing and group interviews. In individual and group interviews, the main interaction is between the interviewer and the interviewees and the main interest is typically the individuals' (idiosyncratic) experiences and understandings. An example of this is classical phenomenological qualitative interviews of individuals, where the primary aim is to get an insight into the "life world" of the interviewees.



Unlike individual and group interviewing, the main interaction of focus groups is *between the participants* of the focus group. For the same reason, the researcher is not having the role as an interviewer (who asks a line of questions and is the main interlocutor for the participants), but s/he is instead the *moderator* of the conversation taking place among the participants. The moderator's role is therefore less obtrusive than in the case of interviewers interviewing individuals or groups. The moderator plays, of course, an important role with regard to framing the focus group and orienting the focus of the focus group discussion (e.g. in relation to introducing discussion topics and asking follow-up questions), but s/he should at the same time generally refrain from interrupting the discussion among the participants (unless if needed). Furthermore, the moderator has a particular responsibility in relation to facilitating a good discussion among the participants; i.e. making room for all participants to express their experiences, understandings and opinions in relation to the topic in question. Also, it is part of the role as moderator to ensure a nuanced discussion of the topics in question. This, for instance, sometimes involves challenging the consensus of the group if this is achieved at an early stage of the group's discussion of a specific topic. See also section 6.3 for more on the role of the moderator and how to moderate a focus group.

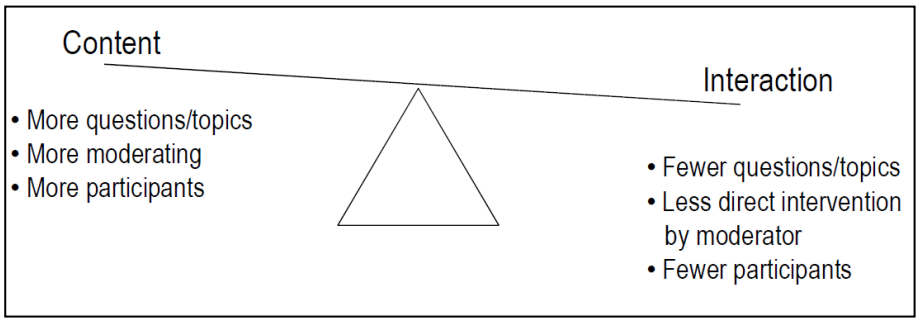
In short, focus groups can be defined as a research method where data is produced through group interaction in relation to a topic that is chosen by the researcher. Or in the words of David Morgan (1997:2): "The hallmark of focus groups is their explicit use of group interaction to produce data and insights that would be less accessible without the interaction found in the group." Aiming at producing data and insights that are less accessible without group interaction is exactly the issue we are facing here in terms of understanding young people's use of IT.

Further, one of the particular strengths of focus groups is that they can be used to make explicit some of the participants' practical understandings and "tacit knowledge" in relation to a specific topic. Through the group discussion, the participants (ideally) force each other to be explicit about what they otherwise take for granted – thus making discursive the repertoires of "taken-for-grantedness" and practical understandings. This is particularly important when dealing with topics that are highly embedded in daily life activities that often become internalized, tacit and routinized. Additionally, due to the nature of focus groups as *group discussions*, focus groups can also give valuable insight into normative understandings related to a specific topic. Normative understandings, which can be closely related to broader discourses in society, are made visible through the participants' exchange and negotiation of different opinions about the topic and how these can be related to the their personal experiences.

6.2 Types of focus groups – content or interaction

Different approaches to how to define and carry out focus groups can be found in the method literature. One of the important differences between these approaches is, as pointed out by Bente Halkier (2008), whether the main research interest of the focus group study is on providing (rich and detailed) data about the topic of the focus group or the main focus is on the normative negotiations between the participants (e.g. concerning what can be regarded as wrong or right behaviour in relation to the topic). Or in other words: Whether the focus of the researcher is primarily on the *content* of the topic-related discussion or on the *interaction* between the participants. In her own work, Halkier emphasises the particular usefulness of focus groups with regard to providing insights into normative group discussions (e.g. of food and health), but she also notes that focus groups "can produce concentrated data about a specific phenomenon or topic in a relatively accessible way that is less obtrusive than, for instance, field work and participating observation" (Halkier 2008: 14 – our translation).

The choice of focus (content versus interaction) has implications for the design of the focus group study. If primary focus is on the content of the focus group discussions, it is in general possible to include more topics than compared to designs with a primary focus on the interaction and negotiations between the focus group members. Similarly, it is also in general possible for the moderator to play a more active role and to have more participants in content-oriented focus group designs compared with interaction-oriented designs.



In relation to this study, our primary interest is on the content of focus groups, as the main aim of is to identify knowledge, attitudes and practices of ICT use of young people. Therefore, the involvement by the moderator has been more active compared to focus groups with a primary focus on the interaction between focus group participants.

However, it was acknowledged that the primary focus on content should not exclude a general interest in normative negotiations about meanings that might occur during our focus groups; for instance, this kind of negotiations could occur in relation to the participants' discussion of what kind of actions or changes in their own everyday ICT use that they would regard as relevant, fair or reasonable in relation to saving energy. Discussions about this kind of normative issues can give a valuable insight into different positions and understandings of what is perceived to be (morally) reasonable or not. In this way, this can give us an idea of the complexity of the field and knowledge about possible barriers and enablers of changing user practices in relation to IT.

6.3 The role of the moderator and how to moderate

As already indicated, focus groups vary with regard to their level of moderator involvement (high or low). In our case, the moderator involvement has beem relatively high.

However, even with a relative high moderator involvement, it is still important to keep in mind that the characteristic of focus groups is the emphasis on the discussions among the participants. Thus, it is a question of achieving the right balance between moderator involvement (at the right instances and in the right form) and, at the same time, ensuring a space for the participants' own discussions. A way of understanding the role of the moderator is to think of him/her as responsible for creating space for an open and inclusive exchange of ideas, opinions and experiences among the participants. Javier Lezaun (2007) talks about creating an isegoric situation. He explains (ibid.: 140):

> "Classical Greek thought described isegoria as the condition of equality in the agora, understood as equality in the ability to express one's own opinions. Isegoria would not describe what we might understand today as "freedom of speech," the liberty to say whatever is on one's mind [...]. Isegoria refers to the formal conditions of an assembly in which citizens would have an equal share in the debate in the agora; it describes the quality of a space in which every member of the community is granted the right and the obligation of deliberative participation."

With regard to how (more specifically) to moderate focus groups, Puchta & Potter (here referred from Halkier 2008) point out four different preconditions that are important for a successful focus group and that it is the moderators' role to ensure*:*

- *Informality* in order to make the focus group safe and "inviting" for the participants active participation. The moderator can ensure informality in different ways, e.g. through his/her way of speaking, choice of clothes etc.
- *Active participation.* The moderator should ensure that all participants take an active part in the discussion, e.g. by inviting persons, who have not said much for a longer period, to express their views or to say if they agrees or disagrees with the others statements.
- *Focus on the topic* of the focus group. The moderator should help to keep the discussion "on track", e.g. by reminding the participants of the discussion topic if their discussion moves away from it.
- Providing a *variety of different opinions* and experiences with regard to the topic. Here, the role of the moderator can be to challenge the consensus of the focus group participants, if this consensus appears early in the discussion or seems created by influence from dominating participants.

With regard to moderating, the literature on focus group methods often distinguishes between two kinds of moderator intervention: *Probing and prompting.*

Probing is invitations to the participants to go into further detail with a specific issue or description; e.g. by asking "please, could you tell more about this?" *Prompting* is typically follow-up questions that aim at making the participants to think of other aspects that are (also) relevant for the topic. Both types of interventions have been used in our focus groups.

In addition to the general guidelines above on how to set up and moderate the focus groups, the moderators were also equipped with more detailed and elaborated guidelines on how to handle specific situation in relation to the focus groups (e.g. how to handle late arrivals, dominant persons or how to introduce the focus groups). These detailed guidelines will not be presented here.

6.4 Aim, focus and research questions

As the overall aim of this study has been to identify knowledge, attitudes and practices of ICT use among young people, a number of research questions have been developed accordingly:

1. Which practices of ICT use do young people have?
2. Do they have knowledge about environmental impacts of ICT use?
3. Do they perceive environmental impacts of ICT use as a problem?
4. What do they think they can change themselves?
5. Which differences and similarities do exist between different lifestyle groups? How can they be reached?

As it can be seen from this, the focus groups both covered more descriptive aspects of young people's ICT use (question 1 and 2) as well as more evaluative/normative aspects (question 3 and 4). Question 5 can be regarded as a more general research question that runs across the other research questions and relates to the analysis of the participants' different statements and positions, and how these relate to different socioeconomic and socio-demographic variables like gender, educational background, social groups etc.

Research questions no. 1-4 have been summarized in the following three research questions for the focus groups:

1. How do participants use IT?
2. What do they think about the relationship between their use of ICT and the environment?
3. What are their opinions about changing user practices in order to reduce energy consumption?

We decided that the focus groups should focus primarily on question 2 and partly on question 3, while question 1 should be covered by a questionnaire that the participants should complete before the start of the focus groups[6]. In addition, the focus groups started with a round there the participants briefly told about their personal use of ICT.

In combination with the mapping of the environmental impact of different ICT usages (reported in Part I of this report), the aim of the focus groups was to provide useful information for the choice of focus of the later work packages in the useITsmartly project. For instance, knowledge on what the focus group participants think about the relationship between their own use of ICT and the environment and about changing practices has qualified the choices in Work package 3 with regard to what sort of ICT usages that should/could be in focus in the creativity workshops and will also work as input for the coming Work package 4 on peer-to-peer education.

Based on these considerations, three discussion topics were developed to be introduced and discussed at the focus groups. The discussion topics will be described in the following section.

6.5 The topics of the focus groups

Before engaging with the discussion topics of the focus group, the participants were asked to fill in the questionnaire in Appendix 1 (translated to the local language). The questionnaire is described in the next section.

After the questionnaire had been completed, the discussion topics were presented and facilitated. Although the focus groups primarily focused on research question 2 and 3, the moderators were advised to start with a more descriptive question about the participants' own use of IT, which also fit well in prolongation to the questionnaire. In this way, it would be easier for the young participants to start talking about the topics, and this also helped creating a relaxed atmosphere. Further, getting a first insight into the participants' understandings of their own ICT use proved helpful for the later analysis of the context of ICT usage as well as provided some background information that was helpful for the moderator in relation to moderating the focus group.

The focus group had the three following topics and related discussion-starters:

Topic 1 – Presentation and use of ICT (Duration: 20 minutes)

A round where participants tell about themselves and their use of IT

In relation to Topic 1, a short introduction of the concept of ICT was given, ensuring that the participants would have a mutual understanding of the concept, and ensuring that ICT would be defined broadly, including both what is "traditionally" considered to be IT technologies such as computer/laptop, internet and mobile/smart phones as well as also other technologies that might be relevant for the participants (e.g. MP3-players, tablets and television).

[6] Our first idea was to cover the context of usage partly by an electronic diary that the participants should complete online. This was tried out in relation to the two focus group pilots carried out in the Netherlands and Denmark, but it was afterwards decided to replace the electronic diary with a short questionnaire because the electronic diary involved many technical problems and also was a very time-consuming approach.

The idea of topic 1 was not to get a detailed description of the participants' ICT usage, but to get an *overall insight* into their own understandings of how they use IT.

Topic 2 – Personal use of ICT and energy and climate change (Duration: 20 minutes)
Discussion-starter: ICT can be used for many different things. What kind of role (positive or negative) do you think that your personal use of ICT plays in relation to energy consumption and climate change?

The aim of this topic was to invite the participants to think about and discuss the relation between ICT, energy consumption and climate change. This was done in order to get an insight into how young people think about this relation (their knowledge and opinions).This discussion-starter was intentionally left rather open with regard to how ICT might more specifically influence energy consumption and climate change. Thus, the scope of the discussion did not from the outset exclude discussions of 2nd order energy impacts of ICT use – for instance related to changes in other practices like transport or printing. Therefore, it left some room for the participants to decide what they think is most important/relevant to discuss.

Topic 3 – Changing use of ICT / saving energy (Duration: 25 minutes)
Discussion-starter: Energy consumption of people's use of ICT is increasing. Today, households use more energy for ICT than for many other things – such as lighting or freezers & refrigerators. As a result, energy consumption for ICT now contributes to greenhouse gas emissions and climate change. This raises the question of whether we should reduce energy consumption for IT. What do you think about the idea of saving energy in relation to your own ICT use?

The aim of this topic was to get insight into what the participants think about changing their own ICT user practices in order to save energy (and reduce impact on climate change). After letting the group discussing this for some time, the moderator introduced a new discussion-starter:

Discussion-starter: Discuss how you could save energy in relation to your personal use of IT. What could you do different? And could you use ICT in ways that would reduce other kinds of energy consumption?

The aim of this discussion-starter was to make the participants generate and discuss different ideas on how to change ICT use practices, as this could form a relevant input for later work packages.

The detailed description of the focus group topics that was used by the moderators can be found in Appendix 2.

6.6 Questionnaire about focus group participants' use of IT

As already mentioned, the participants were asked to complete a questionnaire. This questionnaire asked a few general questions about themselves (age, sex and housing situation) and a number of questions about their ownership of ICT devices, time spend on using these devices and the frequency of their use of ICT for different activities.

The primary aim of the questionnaire was to:

- Collect information about the participants' use of IT, particularly activities that involve (relatively) high energy consumption; i.e. activities that either involves much processing power (e.g. editing photos/videos) and/or high level of data traffic (e.g. streaming video). Also of importance is the time spent on using different devices. This information is part of the context information for the analysis of the focus groups.
- Make the participants more aware about their own use of ICT before the focus group discussion began.

As indicated above, the activities in question no. 10-12 (see Appendix 1) are basically selected as the type of ICT uses that involves (relatively) high energy consumption (either on the device itself and/or in relation to the internet infrastructure due to high levels of data traffic). As the energy consumption of an activity also depends on the type of device being used (for instance game playing on mobile phone versus laptop, with the latter having higher energy consumption in general), questions about frequency of activities are split into three overall categories of devices: PCs/laptops, small portable devices (mobile/smart phones and tablets) game consoles.

In the following, the selection criteria and recruiting process for the focus groups are presented.

6.7 Focus group participants – selection criteria and recruiting

Overall selection criteria

In forming the criteria for the focus groups, it was decided to have a high degree of flexibility with regard to the criteria for recruiting participants, and thereby to focus on different school types/university groups per country (to reach some diversity).

Keeping this in mind, it was recommended that each partner ensured some degree of diversity with regard to who they recruited for the focus groups in their country. This diversity could be related to variables like (for instance):

- Education (e.g. doing focus groups with both vocational schools and grammar schools)
- Ethnicity (e.g. doing focus groups with young people with different ethnicities)
- Age groups (e.g. 16-18 years old and 18-20 years old)
- Interests (e.g. doing focus groups with both particular "IT interested users" as well as "IT low-interest users; doing focus groups with particular environmentally interested young people versus young people not particular interested in the environment).

By ensuring some diversity for each country, this can provide insight into the differences/diversities in relation to ICT usage and understandings of the relation between ICT use and energy/climate.

As we did not employ the same selection criteria for all countries, it is not possible to make comparisons between the countries of ICT user practices and understandings (comparing, for instance, ICT user patterns of vocational trainees across the countries). Instead, the focus groups provide insight into general patterns related to ICT user practices, knowledge and attitudes – and also to compare some overall groups of young people (e.g. male and female participants, different types of education, interests etc.). In this way, it has been possible to get an overall picture of the complexities of ICT user practices and understandings of ICT and energy, which has been useful input for developing the creativity workshops and the toolbox for stakeholders in Work package 3.

Besides ensuring some degree of diversity for each country, it was also suggested that all countries aimed for an *overall* gender balance for their focus groups. Either by having an even mix of woman and men in all three focus groups or by having one female and one male focus group, and with the third focus group being a mixed group.

Thus, the overall selection criteria/guidelines can be summarized as:

- Young people aged 16-20 years
- Ensure some degree of diversity for each country

- Ensure an even gender balance (overall)

With these overall guidelines for the selection criteria in mind, it was up to the partners to make choices with regard to the more specific criteria they would put up for the selection of participants for their focus groups. These specific criteria are presented in the following.

Selection of participants

Austria
The Austrian focus groups were carried out in cooperation with two schools of different educational types. One was a vocational school with a technological curriculum and the other was a general secondary school without specific technological approach. This ensured a certain diversity of the focus group participants with regard to education.

Teachers of the respective schools functioned as gatekeepers and were contacted about the project and asked for their support in finding participants for the focus groups.

The focus groups were conducted in the school settings (in combination with free movie tickets as incentives for the students) to ensure a high commitment of the participating youths. The teachers (who knew the students personally) chose the participants and allowed them to take part in the focus groups during school time (an additional incentive).

Germany
The German focus group participants were recruited through the cooperation network of the Bergische Schul-Technikum. This institution is affiliated to the University of Wuppertal and offers afternoon courses for young people on science and technology topics. The participants were recruited from a school network of over 50 schools (vocational, upper secondary and comprehensive schools) in the area of Wuppertal, Solingen and Remscheid. The courses are targeted pupils form 8^{th}- 13^{th} grade, which translates to ages of 14 to 18/19.

The gatekeeper for the participant recruiting was the coordinator of the Bergisches Schul-Technikum who arranged contacts and access. Through her it was possible to select courses with pupils within the useITsmartly age group.

Norway
Recruitment of focus group participants was done through cooperation with STFK, Sør-Trøndelag County Authority. The County has 22 upper secondary schools with approx. 11.000 students aged 16-21 years. The schools offer general and vocational education. The County Authority is also responsible for apprenticeship training and adult education.

Schools (and teachers) were contacted randomly and the focus group interviews was conducted in available classrooms at the respective schools.

The Netherlands
Recruitment of participants was done among students at Radboud University ensuring diversity with regard to directions.

Denmark
Recruitment of participants was done from a general upper secondary school (“gymnasium”) and a “Produktionsskole” (this is a special public scheme for unemployed young people who are not following any

education) and a "continuation school" ("efterskole"), which is a comprehensive school where the pupils live at the school. For the pilot focus groups, participants from a vocational school were chosen. All schools are placed in Eastern Jutland (the Produktionsskolen and the general upper secondary school in the Aarhus area).

Overall diversity

Even though there was a relatively high representation of young people from vocational and (in particular) secondary schools, the above shows that also other groups of educations were represented (e.g. university students, comprehensive schools and participants outside job or education). Also, participants with a particular interest in environmental issues were selected for two of the focus groups (one Austrian and one Dutch focus group). In this way, some diversity with regard to education and interests has been assured.

Recruitment of participants

As noted by Morgan, "inadequate recruitment efforts are the single most common source of problems in focus group research projects" (Morgan 1997: 38). Thus, a recurrent problem of focus groups is the problem of persons who are not showing up at the focus group. Therefore: "Simply locating participants and getting them to agree to show up is often not enough; instead, it is essential to develop careful procedures that ensure that enough participants actually do show up for each group" (ibid.).

For the same reason, it was very important that each partner thought through and developed a strategy on how to recruit focus groups participants as well as how to avoid the problem of absence. Each partner developed a strategy that was tailored to the local context and the target group of the focus groups.

Overall, the show up at the focus groups was good. However, in a few cases, there was some dropout (particularly in one of the Austrian focus groups; however, measured in numbers, the dropout in this particular focus group was levelled out by many participants in the two other focus groups).

6.9 Analysing the focus groups

On the basis of full transcriptions of the focus group, each partner prepared a 4-10 pages summary/analysis of each focus group. A guideline for the preparation of these summary/analysis reports were prepared by the coordinator in order to ensure consistency across all reports (see Appendix 3). On the basis of these reports and the results of the questionnaire (which were transferred to spreadsheets), the coordinator prepared the final analysis of the focus groups presented in the following chapters.

In order to ensure anonymity, the names of the schools are not included in this report and all participant names in the following chapters are pseudonyms.

6.10 Pilot focus groups

In May and June 2013, Radboud University and the Danish Building Research Institute (in collaboration with Lokal Energi) carried out two pilot focus groups (one in the Netherlands and one in Denmark). The aim of these pilots was to "test" a draft version of the focus group guidelines (including preliminary focus group topics). On the basis of the experiences from these pilots, a number of changes were made to the final focus group guidelines. These included, among others, a reduced number of topics and changes in the order of topics and discussion starters.

As mentioned previously, an electronic diary was also tested (developed by Radboud University). The original idea was to use the electronic diary as a way to record the participants' use of ICT for one weekday and one day in the weekend. During these days, the participant would have to complete a number of online questionnaires with questions about their use of ICT. However, it turned out to be very time-consuming to

develop and carry out these electronic diaries – and it was also questioned whether it gave fruitful inside into the participants' use of ICT. Therefore, it was later decided to replace the electronic diary with the questionnaire presented in Appendix 1.

In the following analysis, the two pilots will be included in the empirical material, as they provided many interesting insights into the participants' use of ICT, thinking about ICT and energy etc.

In the next section, we will give an overview of the focus groups and present some general characteristics about the participants.

6.11 Overview of focus groups and the focus group participants

The following table gives an overview of all focus groups (including the two pilots).

ID	Country	City	Recruitment target group (participants)	Partici-pants (No.)	Females (No.)	Males (No.)
AT1	Austria	Graz	Vocational school (higher technical education)	7	0	7
AT2	Austria	Graz	General secondary school (”Gymnasium”)	8	4	4
AT3	Austria	Graz	Environmentally aware adol. from general secondary school (“Gymnasium”)	2	2	0
NL1	Netherlands	Nijmegen	University students (educational sciences)	8	8	0
NL2	Netherlands	Nijmegen	University students (environmentally interested)	5	4	1
NL3	Netherlands	Nijmegen	University students (computer science)	5	0	5
DE1	Germany	Wuppertal	Vocational school	6	0	6
DE2	Germany	Wuppertal	Upper secondary schools (“Gymnasiums”)	6	4	2
DE3	Germany	Wuppertal	Comprehensive school	6	6	0
NO1	Norway	Trøndelag area	Vocational school (apprenticeship training)	9	0	9
NO2	Norway	Trøndelag area	Vocational school (apprenticeship training)	5	0	5
NO3	Norway	Trøndelag area	General secondary school	11	5	6
DK1	Denmark	Aarhus	General secondary school (“Gymnasium”)	8	4	4
DK2	Denmark	Aarhus	Produktionsskole (scheme for young people unemployed and not in formal education)	8	3	5
DK3	Denmark	Eastern Jutland	Comprehensive school – “continuation school” (“efterskole”) – participants from Technology & science and Design directions	8	2	6
DKpilot	Denmark	Eastern Jutland	Vocational school (apprenticeship training)	7	2	5
NLpilot	Netherlands	Nijmegen	University students (humanities and educational sciences)	5	3	2
Total number of participants				114	47	67

Table 4: The focus groups.

Table 4 shows that the total number of participants in the focus groups was 114 (including the pilot focus groups). The table also shows some gender bias, as 67 of the participants (59%) were males. This bias was not intended from the outset, but was a result of the partners not always being able to ensure that an even gender representation was achieved. Typically, the problem would be that the gatekeeper did not (or was not able to) find an even number of male and female participants.

Even though a better balance between male and female participants would have been ideal, we believe that the bias is not decisive for the final analysis and outcomes of the study.

Housing situation	Germany	Austria	Netherlands	Norway	Denmark
I live with my parent(s)	94%	94%	67%	96%	52%
I live alone	0%	0%	6%	0%	9%
I live with my girlfriend/boyfriend	0%	0%	6%	0%	4%
I live with my roommates	6%	0%	22%	4%	4%
I live in a dormitory	0%	6%	0%	0%	30%

Table 5: The housing situation of the participants

Table 5 shows the housing situation of the focus group participants (based on the questionnaire; pilot focus groups not included). In three countries, the great majority of the participants lived at home with their parents (Germany, Austria and Norway). However, two countries stand out: In Denmark, only half of the participants lived with their parent(s), whereas about one-third reported living at a dormitory. The main reason for this was that one of the focus group (DK3) was carried out at a "continuation school", where the participants live at the school. In the Netherlands, only about two-third reported that they lived with their parent(s), while almost one quarter reported living with roommates. The reason for this is that the focus group participants were university students, and therefore (in general) a little older than the participants from the other countries.

Age	Number of part.	Per cent
16	21	21%
17	33	33%
18	30	30%
19	6	6%
20	4	4%
21	2	2%
22	1	1%
25	1	1%
No answer	1	1%
Total	99	100%

Table 6: The age of the participants

Table 6 shows the age distribution of the participants (pilot focus groups not included). It shows that the great majority of the participants (94%) belong to the age group 16-20 years, while only five participants are older than 20 years (in most cases, these were included because of misunderstandings in relation to the communication with the gatekeepers who selected the participants). Also, Table 6 shows that most of the participants belong to the lower end of the age range 16-20 years; thus, 84% are aged 16-18 years, which can be seen as the result of the focus on general secondary or vocational schools in most countries (typically, these schools are targeted young people that have just left primary/comprehensive school).

7. Young people's use of ICT

In this chapter, we report the main empirical findings from the focus groups in relation to the first focus group topic, which was about the young people's descriptions about their own use of ICT. The presentation focuses primarily on themes, statements and descriptions that came up in several focus groups. The aim is thus to identify more general patterns in young people's own descriptions of their daily use of ICT. The focus group data are supplemented by the results of the questionnaire that the participants' filled in prior to the focus groups.

7.1 ICT devices used on a general basis

The focus groups indicate that for most participants, the mobile phone (most often a smart phone) is their primary ICT device for social interaction as well as entertainment more generally. The participants explain that they always carry their (smart) phones with them and that they often check their phone for messages or use it for entertainment, to read news etc. (see also next section on the use of ICT devices).

	Germany	**Austria**	**Netherlands**	**Norway**	**Denmark**
Television at home (shared)	50%	76%	67%	52%	57%
Television in own room	39%	41%	33%	57%	30%
Any television (shared/own room)	83%	83%	78%	91%	74%
Laptop	78%	88%	100%	74%	91%
Desktop at home	56%	41%	44%	52%	17%
Desktop at school	28%	41%	83%	74%	22%
Mobile phone	22%	24%	0%	48%	17%
Smart phone	83%	94%	100%	87%	78%
Tablet	33%	59%	17%	35%	39%
Game console	50%	47%	17%	48%	30%
MP3-player	44%	35%	28%	26%	26%
Other	11%	6%	6%	0%	4%
Number of devices used in general (average no. per participant)	*4.8*	*5.5*	*4,9*	*5.5*	*4.1*

Table 7: The use of ICT devices (*Which of the following devices do you use in general?*)

As Table 7 shows, 80-100% report to use a smart phone in general, whereas only about 20% report to use a regular mobile phone in general.[7]

Also, most participants report to use a laptop regularly (between 74% in Norway and 100% in the Netherlands). From the focus groups, it is apparent that it is particularly participants within general secondary or higher technical educations that use laptops most frequently due to the close integration of the laptop in relation to both teaching and homework, whereas laptops in general are used less heavily by participants within vocational schools and similar. This relation between type of education and use of ICTs will be described in more detail in the next section.

Many use a desktop PC at home (in general about half of the participants with the exception of Denmark with only 17%), while many (also) use a desktop at their education/school.

Interestingly, the use of tablets varies considerable between the countries (presumably because of differences in target groups for the recruiting of participants). Thus, only about a third of the German, Norwegian and Danish participants report to use a tablet in general, while little less than two-thirds report to use a tablet in Austria. Only about 20% of the participants in the Dutch focus groups report to use tablets regularly.

[7] The total of mobile phone and smart phone is above 100% for several countries. The reasons for this might be (among other things) that some participants might not distinguish clearly between mobile phone / smart phone and they might therefore have reported both (even if they only have, e.g., a smart phone). Also, few participants might have (access to) two phones, both a smart phone and a mobile phone. However, the differences from 100% are small in general, except for Norway and to some degree also Austria, which stands out in this respect.

The use of game consoles are in general reported by about half of the participants with the exception of 30% for Denmark and only 17% for the Netherlands. Regarding use of television, about half report to use a shared television at home in general (with the exception of higher figures for Austria and the Netherlands; 76% and 67% respectively), whereas the percentage of participants using a television in their own room varies more between the countries: Between 30% in Denmark and 57% in Norway.[8] About 80-90% report to use TV regularly (either shared and/or in their own room).[9]

Overall, Table 7 shows that three ICTs stand out as the most widely used: Mobile/smart phone, laptop and the TV set. The use diffusion of mobile/smart phone use comes close to 100% (of all 114 focus group participants, only 2 report that they neither use a mobile or a smart phone), whereas 80-90% report to use laptop and TV set regularly. Many also use a desktop PC regularly at home. In addition, the majority of the participants use also one or more other devices on a general basis (e.g. tablets, MP3 players etc.). The average number of devices reported by the participants range between 4.1 for Denmark and 5.5 for Austria and Norway (see Table 7).[10] Thus, smart/mobile phone, TV set and laptop are typically combined with about two other devices.

It is important to notice that the questionnaire results do not give insight into the general diffusion of ICT use among all 16-20 years old persons in the five countries, but it might give an impression of the overall "weight" of the different ICT devices in young people's everyday life and the results provides data for the interpretation of the focus groups specifically.

7.2 The use of ICT devices

The focus groups and the questionnaires draw a multifaceted picture of the participants' use of ICT. On one side, there are a number of clear and distinct user patterns that can be found across more or less all focus groups (e.g. the importance of social media use). At the same time, also a number of differences can be identified between the focus groups that indicate a certain degree of diversity in young people's ICT usage (e.g. in relation to the use of laptops). In this section, we will give a general introduction to these similarities and diversities, whereas this is followed up in the following sections with a more detailed presentation of some of the general themes that occurred across most focus groups.

Most participants explain that they use ICT extensively in their everyday life. They use a number of different devices for a multiplicity of uses (including school work/education, social media, entertainment, hobbies etc.). In next section the intensive use of ICT will be illustrated through examples on the participants' descriptions of "always being online and available". However, some of the focus groups also include participants that explain that they do not use ICT as heavily as other; indicating some diversity in the general use of ICT. One example of this came up in the Austrian focus groups (AT1), where one of the participants explains that he does not have a laptop (only a PC at home used for gaming in particular) and that he takes notes during teaching on spiral notebook, primarily uses his smart phone when outside his home and mainly to get information and news and, finally, hardly uses social media networks. He explains that he prefer meeting friends rather than "chatting online" with them. In this way, this participants stand out from the other participants in this focus group who generally describe that their own ICT use is both extensive (e.g.,

[8] However, the low percentage for Denmark is partly a result of one of the focus groups being with participants at a "boarding school" or "continuation school" where the participants live at the school – typically with no individual television sets in the rooms.

[9] Again, the relatively low figure for Denmark reflects that only few of the participants in the "continuation school" reports to use TV regularly compared with the other Danish focus groups.

[10] Again, the relative low average number of devices for Denmark might partly be a result of the special situation of the participants from the "continuation school" (cf. previous footnotes).

one says that he is "always connected" through his ICT and always carries his smart phone with him) and involves several devices (smart phones, laptops, tablets, gaming consoles etc.). The questionnaires for this focus group show that the number of devices used regularly ranges from 3 to 10, showing some of the diversity in the degree of ICT usage.

Another example is from the Danish focus groups (DK2), where one participant (Laurits) explains that he does not have a mobile/smart phone at all. This clearly surprises the other focus group participants, and Laurits' remark evokes immediate reactions from the others as shown in this excerpt:

> Michael (?): Isn't it difficult to live without a phone?
> Mesut (?): I don't get it neither
> Laurits: I haven't had it for a year. (...)
> Amira: Are you not allowed to have a phone [for his parents]
> Laurits: Certainly not, I have had many [phones] – I just don't bother. I don't need one.
> Amira: Don't you use Facebook neither, then, and things like that?
> Laurits: Once in a while
> Moderator (THC): So you use a computer?
> Laurits: Yes, and an iPad at home [he seems to mean that he uses a computer at the Produktionsskolen]

Later in the focus group, another participant, Layla, again asks Laurits about his experience with not having a phone:

> Layla: But don't you feel – when you talk with your friends – that they are saying things that you don't really understand [friends talking about new phone apps etc.]? Not that you don't understand it, but – like with Instagram – you don't really understand what it is?
> Laurits: I don't get it at all, what they are talking about.
> Layla: Yes. You are not like "following the fashion"-like. Not in that sense, but –
> Laurits: - well, my friends don't do it that much neither.
> Layla: Well, okay. Then it makes good sense.

The excerpts show that accounts of not using ICT (much) – in this case not having a mobile/smart phone at all – cause surprise and curious questions about how to live without it. The reactions of the other focus group participants indicate that Laurits' account challenges established norms about ownership and use of ICT.

Laurits and the previous participant from the Austrian focus group certainly seem to belong to a minority of the focus group participants with a limited ICT use, but they demonstrate the existence of diversity in the intensiveness of ICT usage among young people. However, the focus groups draw an overall picture of ICT being used widely and intensively by most of the participants.

The responses to the questionnaire give insight into how intensive the use of ICT is in general and how this varies with specific devices specifically. The following table shows how many who use different devices sometimes and how much time they spend on these.

Type of device	Response	All countries
*Use a **laptop** sometimes?*	*Yes*	*94%*
Hours of use on a typical weekday?	Less than 30 min	10%
	About 1 hour	17%
	About 2 hours	24%
	About 3 hours	13%
	More	37%
*Use a **stationary PC** sometimes?*	*Yes*	*63%*
Hours of use on a typical weekday?	Less than 30 min	32%
	About 1 hour	21%
	About 2 hours	10%
	About 3 hours	11%
	More	26%
*Use a **mobile or smart phone** sometimes?*	*Yes*	*98%*
Hours of use on a typical weekday?	Less than 30 min	10%
	About 1 hour	15%
	About 2 hours	15%
	About 3 hours	9%
	More	49%
*Use a **tablet** sometimes?*	*Yes*	*51%*
Hours of use on a typical weekday?	Less than 30 min	54%
	About 1 hour	16%
	About 2 hours	12%
	About 3 hours	8%
	More	10%
*Use a **game console** sometimes?*	*Yes*	*45%*
Hours of use on a typical weekday?	Less than 30 min	36%
	About 1 hour	24%
	About 2 hours	9%
	About 3 hours	16%
	More	13%

Table 8: Focus group participants' use of different ICT devices. Only participants who report to use a device sometimes are included in the "hours of use".

In line with previous findings, the results for all countries in Table 8 show that almost all of the participants use laptops and mobile/smart phones sometimes. Also, about two-thirds use desktop PCs sometimes and about half of them use tablets and game consoles sometimes. When it comes to the intensiveness of the use of these devices on a typical weekday, the answers show that laptops are in general used heavily with about 40% reporting more than three hours per day and three quarters reporting 2 hours or more. As the focus groups show, particularly young people in general secondary schools or higher (technical) educations typically use their laptops extensively in relation to their school work compared to participants in vocational training. Similarly, mobile/smart phones are used intensively by many with about half of the participants reporting to spend more than three hours a day using their phone. However, there are also about a quarter who report to use their phone for about one hour or less a day.

For those sometimes using desktops ("stationary PCs"), the hours of use are relatively diverse, but with an indication of two different groups: Those who use desktops only little (about 1 hour or less per day) and a smaller group of those who use desktops rather intensively (more than three hours a day). The focus groups indicate that the latter group might include many of the participants particularly devoted to PC game playing

as desktops traditionally have been regarded as better for this type of activity due to higher performance characteristics compared to laptops.

With regard to tablets, it is interesting to notice that even though about half of the respondents sometimes use tablets, among this group, the use of tablets is rather limited with half of the participants reporting less than 30 minutes on a weekday and less than a third reporting 2 hours or more. Thus, the use of tablets does not seem widespread among the focus group participants. Finally, for game consoles, the hours of use are relatively diverse (as with desktops), but with 60% of the participants reporting about 1 hour or less per day.

The questionnaire also included questions about how frequent the participants' use a laptop/desktop, mobile/smart phone or game console for a number of different activities like music or video streaming on the internet, online gaming, editing photo/video etc. The results are shown in the following three tables.

Activity	**Daily**	**At least weekly (not every day)**	**Less than every week**	**Never**
Send/receive photos or video by e-mail	14%	19%	48%	19%
Video calls	9%	17%	39%	35%
Upload or watch photos or video on social media	53%	18%	20%	8%
Upload photos or video to YouTube/ Vimeo or similar video-sharing	5%	10%	23%	61%
Streaming music via the internet	54%	22%	9%	15%
Streaming video or television programmes from the internet	45%	31%	9%	14%
Download video, music or podcasts to your own device	14%	31%	36%	19%
Online gaming	13%	15%	22%	49%
Play games	16%	18%	21%	44%
Participate in virtual worlds	2%	1%	8%	89%
Read news or gossip on websites	46%	32%	10%	12%
Use search engines	78%	18%	2%	2%
Download reports or other kinds of larger text documents	14%	31%	33%	22%
Photo or video editing	7%	14%	38%	41%

Table 9: Frequency of use of laptop or desktop for different activities – all countries.

Table 9 shows that laptops/desktops are most frequently used for uploading/watching photos or video on social media, streaming music/video/television, reading news or gossip and using search engines (all used daily by about 50% or more of the participants).

Activity	Daily	At least weekly (not every day)	Less than every week	Never
Send/receive photos or video by e-mail	20%	22%	29%	30%
Video calls	9%	7%	29%	54%
Upload or watch photos or video on social media	49%	24%	9%	17%
Upload photos or video to YouTube/ Vimeo or similar video-sharing	12%	4%	13%	71%
Streaming music via the internet	32%	18%	15%	34%
Streaming video or television programmes from the internet	27%	20%	20%	33%
Download video, music or podcasts to your own device	10%	15%	29%	46%
Online gaming	3%	3%	11%	83%
Play games	12%	20%	18%	49%
Participate in virtual worlds	0%	1%	6%	93%
Read news or gossip on websites	46%	31%	9%	14%
Use search engines	61%	24%	5%	10%
Download reports or other kinds of larger text documents	9%	19%	23%	48%
Photo or video editing	7%	10%	14%	68%
Monitor your health	2%	11%	23%	63%

Table 10: Frequency of use of mobile/smart phone or tablet for different activities – all countries.

Table 10 shows that phones/tablets are most frequently used for uploading/watching photos or video on social media, reading news or gossip and using search engines (all used daily by about 50% or more of the participants)

Activity	Daily	At least weekly (not every day)	Less than every week	Never
Online gaming	5%	13%	13%	69%
Play games on your device	9%	13%	29%	48%
Participate in virtual worlds	1%	2%	7%	90%

Table 11: Frequency of use of game console for different activities – all countries.

Table 11 shows that game consoles are not in general widely used, and only about one out of ten participants use game consoles daily. Game consoles are mainly used for playing games on the device and (to a lesser degree) also online gaming.

Laptops/desktops		**Mobile/smart phones and tablets**	
Activity	**Daily/ weekly**	**Activity**	**Daily/ weekly**
Use search engines	96%	Use search engines	85%
Read news or gossip on websites	78%	Read news or gossip on websites	77%
Streaming music	76%	Upload/watch photos or video on social media	73%
Streaming video or television programmes	76%	Streaming music	50%
Upload/watch photos or video on social media	71%	Streaming video or television programmes	47%
Download video, music or podcasts to device	45%	Send/receive photos or video by e-mail	42%
Download reports/large text documents	45%	Play games	32%
Play games	34%	Download reports/large text documents	28%
Send/receive photos or video by e-mail	33%	Download video, music or podcasts to device	25%
Online gaming	28%	Photo or video editing	17%
Video calls	26%	Video calls	16%
Photo or video editing	21%	Upload photos/video to YouTube/Vimeo etc.	16%
Upload photos/video to YouTube/Vimeo etc.	15%	Monitor your health	13%
Participate in virtual worlds	3%	Online gaming	6%
		Participate in virtual worlds	1%

Table 12: Comparing the frequency of use of laptops/desktops and mobile/smart phones for activities. Shows the share answering daily or at least weekly and ordered by level of frequency.

While Table 8-11 provide details for each type of device, Table 12 compares the frequency (daily or at least weekly) of use of laptops/desktops and mobile/smart phones and tablets for different activities. Table 12 shows that the five most common uses are the same for laptops/desktops and phones/tablets (although the order of frequency of use differs between the two types of devices). In both cases, most participants report to use these devices for search engines. Similarly, reading news or gossip on websites is very widespread (second most common activity) on both PCs and phones/tablets. Music streaming, video/television streaming and upload/watching photos/video on social media follow as the next most common uses for both types of devices (about 50% or more at least weekly), even though phones/tablets are less frequently used for streaming music, video or television than PCs.

Table 12 shows that data-intensive ICT uses like streaming and uploading/watching photos/video via social media are among the most widely uses of both phones/tablets and (in particular with regard to streaming) PCs. The high frequency of use of phones/tablets for uploading/watching photos/videos might be closely related to mobile devices often being used for accessing social media – and because of the integration of cameras in (smart) phones, which makes it easy to take and share pictures or videos.

Higher more than 5 percentage points higher	**Similar** +/ 5 percentage points	**Lower** more than 5 percentage points lower
Send/receive photos/video by e-mail Monitor health	Read news or gossip on websites Upload/watch photos/video on social media Play games Photo or video editing Upload photos/video to YouTube etc. Participate in virtual worlds	Use search engines Streaming music Streaming video/television programs Download reports/large text docum. Download video, music or podcasts Video calls Online gaming

Table 13: The frequency of use (daily or at least weekly) of phones/tablets *compared with* PCs

Table 13 gives an overview of the frequency of use of phones/tablets compared with PCs for the activities included in the questionnaire (primarily activities related with high energy consumption). It shows that the

phone/tablet are only used more frequently than PCs for two activities (send/receive photos/video by e-mail and monitor health).

It is of course important to emphasise, that behind the general figures presented above, one finds a great diversity in different uses and user patterns between individual focus group participants and between focus groups. An illustration of the diversity within just one focus group is the Danish focus group DK1: Except for music and video streaming as well as social media (Facebook in particular) being very widespread, there are important differences in how the participants use their ICT. Some (2+) are very interested in game playing and spend a lot of time on this, while others do not play computer games in general or at all. Others like to search for information about topics, which they are interested in, as a kind of spare time activity, while others do not seem to share this type of interest. A few (2+) uses their computer (and MP3 Player) as an integrated part of creative interests like music playing or drawing, while others do not. Some (2+) likes to watch television for relaxation (e.g. Disney Channel) or have the TV set running "in the background", but others prefer to see movies/programmes/video clips on the internet or not having the TV set running in the background.

In some of the focus groups, the moderators asked the participants whether they could identify different subgroups of ICT uses or users. In most cases, the participants came up with the traditional (stereotypical) group of "computer nerds". However, in two of the Danish focus groups (DKpilot and DK3), this category was elaborated a little further by the participants (maybe because of some of the participants belonging to what the other participants would think of as the computer nerds). Thus, the participants in the Danish pilot focus group suggested distinguishing between people who spend much time on gaming and people who "can more than just playing games", i.e. who are interested in computer techniques and know a lot about computers and how they work. With regard to the latter, one of the participants (Morten) explains:

> Morten: I'm thinking of those who help you, if you have troubles with your computer – then they just fix the whole thing. That's those who I would put in that group [the computer nerds], instead of those who are sitting and playing. Those, who are sitting and playing, are actually a quite large percentage...

There seemed to be consensus among the participants in this focus group with regard to the distinction between the "computer nerds" and the "game players" (with some people being both).

In the same way, some of the participants in the DK3 focus group talked about some people being heavy or skilled ICT users in the meaning that they use ICT for non-mainstream uses like programming and video editing. Similarly, the participants in the NL3 focus group with computer science university students thought of their own ICT use as typical for computer science students, but not for all students – let alone all young people. For instance, one of the participants (Simon) explains:

> Simon: Other groups watch TV more often I think. But well, what are we doing in that time? We are busy with our computers, configure them like you want. We know a lot better what the possibilities are.

Apart from "computer nerds" and "game players" etc., the focus groups did not identify other specific subgroups of users (although: see also later on gender and the role of education).

In several focus groups, the participants were also asked how they perceived their own use of ICT compared with that of their peers. In most cases, the participants did not think of themselves as different from most others, although two focus groups described themselves as more skilled or above average ICT users (AT1

and NL3; in both cases participants from technical educations). In one case, the participants made a distinction between their own use and how "freaks" use ICT (DE2).

internet security did not in general come up as an important theme in relation to the participants' descriptions and discussions of their own ICT use, except for a few focus groups (including the above-mentioned focus group with computer science students in the Netherlands and the Austrian focus group with a general secondary school AT2). This is a little surprising, as the media coverage of NSA and whistleblower Edward Snowden was at its high at the time of the focus groups. This indicates that internet security and privacy are not a general concern for most young people.

7.3 The role of education?

Several of the focus groups indicate that for many of the participants, the use of laptops is strongly associated with school-related activities. This also indicates that the use of laptops (and desktops) is to some degree dependent on the type of education. One example can be found in the Norwegian focus groups, where the participants in the focus group with participants from a general secondary school (NO3) describe a more intensive use of their laptops than the two other Norwegian focus groups with participants from a vocational school in apprenticeship training (NO1 and NO2). The NO3 participants all use their laptop or desktop two hours or more during a typical weekday. The following three quotes illustrate some of their ways of using computers:

> Halvar: "I check Facebook a few times every hour. When I come home from school I turn on the PC. So, I am using it all the time."
>
> Karoline: "It depends on what kind of day it is. Some days I am using the PC for school work all day."
>
> Erling: "I think PC is much more convenient. Because if you have a PC you can play games, you can also use Facebook and do school work and other things. You don't need two technologies [console and PC]. It's more convenient to have all in one!"

Similarly for the Danish focus groups: Except for two, all of the seven participants (unemployed and not in formal education) in the focus group at the Produktionsskolen use their laptop for an hour or less on a typical weekday, whereas most of the participants in the two other Danish focus groups (from general secondary schools) use their laptop for three hours or more (14 out of 16 participants). Also, most of the participants in the Danish pilot (DKpilot), who was in apprenticeship training at a vocational school, described that they used their computers relatively little – especially when they were in traineeship and not following courses at the school. Thus, the participants explained that they primarily used the computer for school-related work – and therefore, they tend to use it much more during periods on the school compared to periods where they are at their company (apprenticeship). Also, when using computer for school-related work, they also spend more time on social media (mainly Facebook) compared to when they are not using computer. Working on a computer, one has access to the internet and other internet-related activities compared to when you (for instance) is occupied with doing carpentry work etc. Examples are Frederik and Lisa, who both experiences that they use ICT more when they are at the school, and Sebastian who explains that he in general uses his smart phone and to a lesser extent his computer, which is primarily used while he is at the school, i.e. for school work.

Thus, participants in apprenticeship training or similar education seem to use computers less intensively and mostly for activities related to entertainment (e.g. streaming video) or social communication (e.g. Facebook) compared with participants from general secondary schools and university. In other words: For participants

in a vocational school, the computer work less as a "tool" for educational work (home work etc.) and is mostly integrated in activities not related to education.

7.4 The role of gender?

A comparison of the male and female participants' responses to the questionnaire questions about how frequent they use computers, mobile devices and game consoles for different activities (in table 8-11) shows that generally, the differences between the genders are relatively few for most of the usages. Especially for mobile devices (smart/mobile phone and tablets), the differences seems few and are typically within 20 percentage points – the only exception from this is using mobile devices to send and receive photos or video via emails, where 39% of the male participants report that they never do this, whereas this is only reported by 18% of the female respondents. Thus, the female participants seem a little more likely to use e-mail on their mobile device to send/receive photos/video. They typically report weekly or less than every week (both 30%).

Larger gender differences are found for computers (laptops/desktops) and game consoles. The male participants in general report a more frequent use of computers for the activities asked about in the questionnaire; especially for streaming music via the internet (64% of the male participants answer daily compared to 39% of the female participants), streaming video or television (55% compared with 32%), online gaming (23% compared with 0%) and playing offline games (25% compared with 5%). Thus, the male participants stream music/video and play games on their computer much more frequently than the female participants. Also, it is interesting to notice that the gender difference is most distinct for playing games on computers with 71% and 66% of the female participants answering that they *never* play online games / offline games compared with only 33% and 28% (respectively) of the men.

Similarly for game consoles, very few of the female participants report to do online gaming or playing games on device (offline) daily/ weekly (2% and 9%, respectively) compared to the male participants (29% and 31%, respectively).

Thus, the findings from the focus group questionnaires to some degree reproduce the (stereotypical) understandings of gender differences with men more occupied of game playing (online as well as offline, on computer as well as game console). Also, the male participants seem to use computers more for music and video streaming, whereas the female participants seem more likely to use their (smart) phone to send/receive photos/video.

With regard to what ICT devices the participants use in general, fewer male participants than female use shared television at home (48% compared with 76%), while more male participants use a television in their own room in general (48% compared with 29%). Other major differences with regard to devices used regularly include more male participants using a desktop at home (55% compared with 22%) and, in particular, game consoles (57% compared with only 12% for the female participants). Overall, a higher share of the male respondents report general use of all devices, except for laptops (79% and 95% male and female respondents, respectively) and smart phones (84% compared with 93%) – and shared television at home, as mentioned before.

With regard to how many hours the participants use on different types of devices on a typical weekday, a comparison of male and female participants shows no large difference with regard to laptops, mobile/smart phones and tablets, while female participants in general use desktops much less than males (only 5% of female participants report "more than 3 hours" compared with 39% for male participants; only participants

who sometimes use a desktop is included). The same goes for the use of game consoles: No female participants report to use game consoles for two hours or more on a typical weekday, whereas 47% of the male participants report this.

Thus, male participants in general use less shared TV at home (but more TV in own room) and more often use desktops and game consoles. No major gender differences are found in relation to use for laptops, mobile/smart phones and tablets.

Gender differences came up as a theme in several of the focus groups. In general, the focus groups reproduced the typical understanding of young men being more engaged in game playing (on computer and/or game consoles) and young women being more engaged in social media. For instance, in the German focus group with general secondary schools (DE2), the participants describe how boys use the computer rather for gaming purposes, while girls use their mobile phone for communication to a more extended degree and for shopping. This distinction seems to be completely natural for them. The participants in the German comprehensive school focus group (DE3) describe similar gender differences in ICT use (such as girls rather using their smart phones and boys more often playing on game consoles). A similar representation is articulated by the Norwegian focus group with participants from a general secondary school (NO3), where it is stated that males are more often doing homework and playing games, while females are more often using Facebook and Instagram. Also in the Danish focus group with Produktionsskolen (DK2), the participants think that it is mostly girls that use Instagram.

With regard to game playing, the focus group participants' descriptions of their own use of ICT do indeed support the understanding of young males playing games, as it is mostly male participants who talk about this. Particularly two focus groups included much talk about gaming (NO1 and DK3), and both consisted of either only males (NO1) or a majority of males (DK3). In addition, a few participants are interested in programming, and these are mostly males. However, the picture seems less clear when it comes to social media as both male and female participants talk much about their use of these (see also next section).

7.5 Social media use

Social media like Facebook, Instagram, Twitter and WhatsApp are in general widely used by the participants, although some services are more widespread than others and differences between focus groups and countries are found. At the time of the focus groups, there were some media reports about a possible decline in Facebook use among especially young people. Also, the relatively new instant messaging service WhatsApp Messenger seemed to be in growth.

In relation to the comparison of the participants' use of different social media services, it is important to keep in mind the differences between these services. For instance, while Facebook and WhatsApp are both social networking media that facilitates communication between friends and acquaintances, they work to some degree in different ways. Facebook is to a high degree similar to maintaining a personal "blog" with personal information (posts on "the Wall") and with the possibility of others to comment on one's "posts". In addition, Facebook includes other features like instant messaging (chat) and event planning etc. Facebook was originally developed for use on computers, but is today highly integrated on mobile platforms like smart phones and tablets. In comparison, WhatsApp seems more centred around the feature of instant messaging (compared to the focus on the personal wall posts in Facebook), i.e. that WhatsApp in particular facilitates text messaging between users and also includes the options for sharing images, video and audio messages. For instance, in one of the Dutch focus groups (NL2), the participants describe that they prefer WhatsAp for

direct communication (text messaging) because WhatsApp is a quicker way to get in touch with others. Thus, WhatsApp seems to a high degree to have replaced traditional text messaging (SMS).

Furthermore, while Facebook started as an online service mainly accessed through the computer web browser (but today often accessed via a smart phone app), WhatsApp is from the beginning built as an application for mobile devices.

Overall, the focus groups show that Facebook and WhatsApp are the most widespread social networking media (although with important differences between countries), while other social media like Instagram, Twitter and SnapChat do not seem to have the same degree of general use (even though these are mentioned in some focus groups). Therefore, focus in this section will be on Facebook and WhatsApp.

The focus group indicates that the use of WhatsApp is particular widespread in Austria, the Netherlands and to some degree Germany, whereas WhatsApp is rarely mentioned in the Danish and Norwegian focus groups. On the other hand, Facebook is still widely used by the participants in the Norwegian and Danish focus groups, while there seems to be less focus on Facebook in the Austrian, Dutch and German focus groups. One of the reasons for WhatsApp not being widely used in Norway and Denmark might be that it is common to include free text messaging in the mobile phone subscriptions. Thus, the benefit of free text messaging related to WhatsApp might not seem as attractive in Norway and Denmark as compared to countries that do not have mobile phone subscriptions including free text messaging.

Even though WhatsApp seems to be the main social media used in Austria, the Netherlands and to some degree Germany, Facebook does not seem to have "disappeared" as such in these countries; rather, it seems as Facebook has assumed a more subordinated role in comparison with particularly WhatsApp with regard to instant messaging with friends/schoolmates, while it is still widely used for other specific activities like planning/organising events or staying in touch with friends and family abroad. Further, it might also be that using Facebook to some degree has become a routinized and trivial everyday practice (i.e. "normalised"), while other services like Instagram and (in particular) WhatsApp in some countries take up a role of being a new and fashionable way of communication. In relation to this, it is interesting to notice that in some cases Facebook has been integrated as a tool in relation to school work (also adopted by the schools and teachers themselves); thus, in one of the Austrian focus groups (AT1), the participants explain that a Facebook group has been established for class-related communication. This might illustrate how Facebook has become integrated and normalised as one among other means of communication in many institutions.

The Austrian focus groups also give another example of the new role that Facebook seems to have adopted (at least in some countries), as one of the participants explain that he uses Facebook, among other services, to stay in contact with his family in South Africa (AT2) and another participant (in AT3) explains that she rarely uses Facebook, except for communicating with friends abroad as Facebook is the easiest and fastest way for chatting.

Like in Austria, WhatsApp is widely used in the Netherlands. The focus groups indicate that WhatsApp is not only used for communication (staying in touch) and coordination (making appointments etc.), but also to "fooling around" (as one participants in NL2 calls it) like sending each other pictures, jokes and gossip. At the same time, several participants describe the flow of messages via WhatsApp as something that in many situations distract them from other things that they feel they should actually do (like studying) in their daily life. The participants compare WhatsApp with a "flood of nonsense", and it seems that especially the "group messages" (multi-recipient messages) often is mainly about jokes or very unimportant information. Not

everyone is able to cope with this in a relaxed way. For instance, one participant (Jinka in NL1) feels a strong appeal coming from the questions that people ask her. Some participants seem to have developed strategies to avoid distractions. For instance, Jan does not look at all the messages all the time (only once in a while), while Astrid reads new messages as they come in, decides when she will respond to them, and then leaves it at that. Karen explains that she skips a lot of messages; also to the extent that she sometimes forgets that there was something important she should respond to. There is always a risk of missing something: there is so much information that people also chose to skip messages. Some respondents feel their lives are sometimes being taken over by this. This theme about distractions by ICT usage also relates to the next section on "always being online and accessible".

The participants in the Dutch focus group (NL2) also talk about the experience of a "group pressure" for being on WhatsApp. The latter is a result of WhatsApp being widely used for communication and coordination, and one therefore feels a pressure to use WhatsApp in order to become part of the communication circles. In addition, WhatsApp also seems to work as an object of distinction and as an "object of desire"; e.g., in one of the German focus groups (DE3), the participants are making fun of one of their friends for not having WhatsApp on her mobile phone. Both aspects (to be part of communication circles and WhatsApp as fashion) also seem to be drivers for the acquisition of smart phones more generally, as one need a smart phone in order to run the WhatsApp application.

In Norway and Denmark, WhatsApp does not (yet) seem to be as widespread. However, the focus groups come up with some of the same descriptions about distraction and the feeling of group pressure in relation to Facebook.

In particular the Danish pilot focus group (DKpilot) came up with a detailed description of how the participants used Facebook. For instance, some of the participants use Facebook for communication and planning in relation to interest groups (senior scouts and skaters), while all participants use Facebook for posting messages on the wall, looking at their friends' posts, chatting with friends etc.

Even though all participants in the Danish pilot are Facebook users, some seems to use it much more than others. For instance, Rene does not use Facebook much. He mostly uses Facebook to see if there are any parties (social events), but when communicating with friends, he prefers to use traditional text messaging (SMS) or make phone calls.

Lisa thinks that those who are still in primary school use Facebook much more than she and her peers:

> I think that those, who are still in primary school, are checking Facebook much because you use your computer all the day – but the group here [she and her peers], you are working [in their apprenticeships], and when you get home the computer is maybe not exactly the thing that you'd bother to look at.

In relation to the pilot focus groups, the participants were asked to fill in an electronic, online diary on their ICT usage. Doing this, had made one of the participants, Morten, surprised by how much time he actually spends on Facebook during the lessons at the school:

> Morten: (...) at the time [of the diary] we are staying a lot inside and having lessons all the time – when you should say how much [time] you had spent on the different [uses/devices], it was a little surprising that I had actually been sitting and shifting back and forth between what was education materials [doing school-related work] and then for instance Facebook. So, you had spent almost the same amount of time on the two things, and it was actually a little scaring that you are that little concentrated on it [the teaching], in a sense.

Morten thinks that it is because it is so easy to check Facebook regularly while you are working on the computer. And he finds Facebook time-consuming and captivating: "As soon as you are taking that five minutes break [with Facebook], it is difficult to get away from it again". Similarly, Sebastian explains that if you are having some "tough classes", when "the phone is right in your pocket, so you can easily do something with it (...) (like) Facebook, read news, play a game or similar."

As Morten points out, Facebook can divert one's attention, and for the same reason Lisa closes down Facebook "when I make exercises". Asked why, she explains that she cannot ignore the new message notifications from Facebook.

As the above show, many of the same themes that came up in relation to WhatsApp in the Austrian, Dutch and to some degree also German focus groups can also be found in the Danish and Norwegian focus groups in relation to Facebook.

Both Facebook and WhatsApp (like other social media) seem mostly accessed via smart phone applications, although there are also indications of participants who use computers much in relation to their education (e.g. for writing reports, doing exercises or searching information) also often access Facebook via their web browser on the laptop or desktop (typically by having Facebook open in a separate window). WhatsApp, on the other hand, can only be accessed via smart phones.

7.6 Always being online and accessible – and using ICT to fill in empty time

Always being online and accessible is a theme that cuts across most of the focus groups. The frequent use of Facebook and other social media has already been described in the previous section. As one of the participants in the Norwegian focus group NO3 explains:

> I check Facebook a few times every hour. When I come home from school I turn on the PC. So I'm using it all the time.

This practice of frequently checking social media, in particular Facebook and/or WhatsApp, seems widespread – often supported by applications on the ubiquitous and "always-at-hand" smart phone, which (by default) notify the user every time there is a new message etc. As the questionnaire showed, most of the participants use a smart phone (80-100%).

In the Norwegian focus group NL3, several comment on the "need" to be online and connected all the time. For instance, Kristian thinks that "it is very important to be online", and another one talks about that "you need Facebook if you want to be part of society", partly because social events etc. are planned through Facebook: "There are not many people that are sending out paper invitations anymore. Usually you will be invited through Facebook groups. The information will be posted there".

Another participant, Åsild, explains that she feels naked without her smart phone: "Maybe someone wants to talk to me, someone that want to tell me something, or do I miss something?" Similar expressions are found in other focus groups: For instance, a participant in AT3 describes how "people panic because the batteries of their mobile phone run low", the participants in NL1 talk about how they want to have access to the internet all the time because otherwise you miss to many messages, and one participant in DE3 describes how it feels like "everything is quiet" when she is not online/connected, while another compares the use of the smart phone to a "basic need" and how she misses the phone if she does not have it at hand and feel an "urge to look at what happened in the time [since she was online last]."

In the Austrian focus group with participants from a higher technical education (AT1), the participants discuss the development over time in the use of smart phones, as they have experienced this, and one of the participants makes some reflections on different approaches to be "available". He says:

> Either you are permanently available or never. To reach a happy medium where you say, it doesn't bother, it only enriches life… I think, personally I feel pretty much available, I'm available all the time for everybody and that's perhaps not worthwhile, that's somehow an invasion into one's privacy which we impose on ourselves.
> (...)
> I personally feel that I miss something when I'm not available. And I think I've heard about this fear and this addictive behaviour, that you are afraid to miss something. If you are not in social networks, not available on smartphone and the like, that young people feel that they might miss something. Older people not, like, when they are happy to put away their mobile phone and switch it off and not being available."

As the above statements from the different focus groups (and those presented in last section) show, the participants in general feel a strong urge to always keep their (smart) phones at hand and being online and available. Partly because of the social connectedness associated with using the phone for communication with their friends etc.

However, another part of the explanation for the need to stay online all the time and the feeling of being "naked" if not having (especially) the phone at hand can be related to the use of ICT (and in particular smart phones) for entertainment and to "fill in" time between other activities. For instance, Erling (NO3) says that: "Once you have a dull moment you will use the iPhone" (e.g. for gaming or streaming video). Similarly, Kristian argues that if you have a boring moment on the bus you don't sit there doing nothing. You have to do something:

> "It's not very acceptable to talk to a stranger when you are sitting on the bus in Norway. If you just sitting there staring, people are going to wonder if there is something wrong with you".

Similar statements can be found in other focus groups. For instance, the participants in NO1 explain that they, e.g., use their phones for entertainment during boring periods at school. A similar example come from DKpilot, where Sebastian explains that if one is having "tough classes", then "the phone I right in your pocket, so you can easily do something with it (…) [like] Facebook, read news, play a game or similar." Another example of the use of smart phones as a pastime activity is a participant in focus group NL2, who uses her smart phone to "fill out" time, e.g. when she is travelling by train or waiting for a train, and also "between things" and during breaks she is used to "look at" her phone.

The participants in the NO3 focus group also talk about that when they have nothing to do it is comfortable to pick up the phone, which indicates that this is not just about pastime or amusement, but also that they feel an expectation of "doing something" or being "busy" with something while waiting.

At the same time as ICT (and in particular the smart phone) is used for staying in contact with friends and for entertainment and to fill in boring gaps, many focus groups also raise a more critical concern with regard to the possible negative influences of always being online. It is particularly the problems of being distracted from other activities and the feeling of being "being addicted" that is mentioned, but some also talk about the possible anti-social character of always being occupied of online activities instead of keeping one's focus on the present situation and the persons you are together with face-to-face (physical co-presence).

In one of the German focus groups (DE2), several describe themselves as "addicted" users of mobile/smart phones. For instance, one participant explain that she is addicted to her smart phone and that she uses it more than her laptop; she mainly uses her phone for communication such as Facebook, WhatsApp and text messaging. Interestingly, another participant explains that she felt a change then she got a smart phone:

> I have only had this mobile phone since April, and before I had an old phone, which could only be used for sms and photography. Then, the addiction was not so big.

In the same focus group, all participants use their mobile phone for Facebook and WhatsApp, but especially the female participants mention their high degree of usage as "addiction". Also, several participants across the focus groups talk about checking messages and news (on their phone) as one of the first things they do in the morning.

Some of the feeling of being "addicted" seems to be associated with experiences of "mindless" use of ICT – e.g. in relation to the use of YouTube, Facebook, surfing the internet etc. For instance, this came up in the Dutch focus group NL3, as this quote illustrates:

> Tom: I catch myself [in] watching videos on You Tube endlessly. From one to another.
> Simon: YouTube is the worst. It can ruin your whole afternoon. Then you think: 'What did I actually do the last 4 hours?'

Similarly, one of the participants (Anders) in the Danish focus group DK1 talks about how he is sometimes surfing around the internet without actually being aware of the websites he looks at:

> Anders: Sometimes I just visit [a website, social media etc.] – and it is not even certain that I'm reading it – I'm just scrolling down [the page].
> Several: Laughs
> Sarah: Yes.
> Anders: I'm just scrolling – I don't know what I'm doing – I'm just scrolling down.
> Several: Laughs
> Anders: And then sometimes – 'Hey, there's something' – [and] then I just go [follow a link] – and then I go back – and then I'm scrolling further.

Anders' explanation seems to illustrate how much ICT usage has become an embodied, non-reflexive and routinized practice that is sometimes performed almost "automatically" and without much awareness. It illustrates the "phlegmatic" and somewhat disinterested character of much internet usage, which is often about amusement or pastime activities (for instance in relation to feeling bored while doing homework). Thus, ICT in general represent an (more or less) always accessible temptation for diversion and entertainment – and this is at the same time recognised in several focus group as a problem and something that distracts attention from other activities (like doing homework).

Several of the focus groups also evoke what seem as more traditional and cultural-critical evaluations of the possible negative consequences of ICT usage. For instance, the environmental-interested participants in NL2 discuss the use of ICT within a more general frame of consumption critique. Especially Jan raises a critical voice: He points out that people at their own age are addicted to consumption, and he thinks there are many things that you could ask yourself whether you really need. There have been a lot of developments, but he wonders if he really wants them. Mirjam opposes this general critique by pointing out that in the Middle Ages people did not have a lot of medicines and did not really miss them at that time, but now she is happy that we do have them. Jan agrees with her in terms of cars and medicine, but asks if it is really necessary that

everyone have Facebook? He thinks that maybe "we" want too much, and that the modern ICT also have caused a hardening of society:

> Everyone [is] sitting behind a thing instead of going out and visiting people. And the older people they often don't understand those things; they miss out on it and become lonely because all the interaction goes through this medium. This is what's eating me that the older part of society cannot follow.

Jan does not like the side effect of exclusion that comes with modern technology.

Other focus groups also talk about the potential alienating and "anti-social" consequences of ICT usage. For instance, the participants in NO2 talk about social versus anti-social behaviour with the latter related to the use of ICT; as Morten puts it: "You do not meet other people by talking to them over the net, this is not being social, it is being antisocial. Hiding from the rest of humanity in a basement!" Here, Morten seems to make a distinction between mediated interaction (being not real or authentic) and physical coprecense / face-to-face interaction (being the real and authentic mode of interaction). Similar expressions also come up in some of the other focus groups – for instance Åsild (NO3), who tells that she uses her phone all the time, but makes a similar distinction between being social and being "techo-social": "You feel that you are social when you are using the phone, but actually you are becoming less social. You don't see people anymore. You just communicate through a social media – Facebook. It's different."

Another example of a critical stance on ICT use comes from the Danish focus group DK1, where one of the participants (Morten) introduces the viewpoint that much ICT use is not really necessary:

> Morten: I just think that it is because we are superficial all of us – and need something that has to entertain us all the time. We have become too lazy, that's what I think. Really, we do not need tablets, we have a phone, we have a computer. We don't need smart phones – I have a phone like this. A phone is made for calling and texting. Ehh, again [it's about] entertainment. Search engines – that's, on the other hand, necessary, but games – that's pure entertainment. It's just to disturb the pupils.
> Sarah: But we use it all of us.
> Anders: Disturbances and entertainment. It is pure entertainment. That's just how it has become. It is pure laziness nowadays, yeah. Really, it isn't anything else – nobody is going out for a run anymore. No, they are going inside and sit down on the sofa and watch a movie, because they can. (...) Really, in my world that doesn't make sense, and that's why I don't see much television.
> Mette: Well, that's not because of the energy consumption [refers back to a previous discussion on ICT and energy consumption] – that you don't watch television.
> Anders: No. I'm not thinking so much about that [energy consumption] – I'm more thinking about the laziness. (...)
> Clara: But it has become a sort of a human right – or that's what I think at least – that thing with – that it is a human right to keep myself updated. (...) Well, as you said about playing – well, if people want to do something, they can have an old-fashioned game of cards and do a solitary, dammit. You don't need a computer to do a solitary. But that's just become like that inside our heads – that we have a demand and right to do these things, right. It has just become normal. (...).
> Anders: So, if everyone has a tablet, then it is normal that you are going to have one. Then I'm also going to have one like that. (...) Everyone is playing [on the computer], then you are also just doing it.

Asked by the moderator whether they really could do without using ICT for entertainment, Anders repeats the argument that "It is just because it's there. If it had never been there, then there would be nothing to discuss, right." August adds: "I could also easily stay from playing PlayStation – but it is just because you have the opportunity for it."

The discussion in DK1 illustrates how the classical, cultural critique of (new) media use as being alienating and/or being less valuable/low-quality or unauthentic compared to more "real" and authentic activities like meeting other people in person or playing traditional (card) games etc. comes up in several focus groups. Also, in some focus groups a distinction between "necessary"/"relevant"/"useful" versus "unnecessary"/"irrelevant"/"non-useful" use of ICT was made.

It is interesting to notice that classical conceptions about media consumption like those known from the Frankfurter School and critical theory still seems to be around – even among young people today. It is also worth noticing that this seems to represent a more general dilemma or ambivalence among many young people with regard to their experience of their own use of ICT. On one hand, ICT offer (from their perspective) positive options for social interaction, entertainment and pastime activities, convenience and even status, but at the same time they also associate their own use of ICT with aspects like waste of time and alienating, mediated social interaction.

As also mentioned previously, and on a less abstract and more "practical" level, many participants feel that the use of ICT – and especially the use of social media on smart phones or as multi-tasking on computers – often distract their attention from other activities such as doing school-related work. At the same time, this seems to be experienced as a tempting diversion from other activities (which might sometimes be experienced as dull or boring), but many participants also recognise this as a problem as it distracts their attention from important things. Some participants explain how they have developed strategies to avoid this kind of distraction, e.g. by closing down Facebook while doing school work.

7.7 Streaming music and video

Streaming of music and video seems widespread among the focus group participants. With regard to music streaming (e.g. Spotify or via YouTube), this is done on a daily basis via computer by about half of the participants and via smart phones by about one-third.

Video streaming is done both on smart phones (about one-third of participants on daily basis) and computers (about half on daily basis). Also, some participants mention that they stream video on smart TVs. Many participants seem to frequently stream video content via YouTube or similar websites – e.g. via links they get from others or find on websites. This is typically video clips. With regard to movies and TV serials, many also mention that they watch TV serials (e.g. via the website of their national broadcasting channels) or use movie streaming services like Netflix and others.

While video clips from YouTube and similar sites are often streamed on smart phones, it seems as TV serials and movies are more often streamed via computer (typically laptops). However, there are some examples of participants who explain that they sometimes lie in their bed and watch e.g. a TV serial before they fall asleep. For instance, one of the participants in NL1 explains that she uses her phone when she is in bed to look back at TV programs she missed earlier. Similarly, Layla (DK2) says: "When you are like being in the bed – before you are going to sleep – then you can just go and look at something".

The use of video streaming seems closely related to convenience, as you can choose time and place for when you want to watch a movie or serial independent of when it is shown on the traditional broadcasting channels. Also, an important aspect might be that as almost all participants have their own computer or phone (while many do not have their own TV set), this makes it possible to watch video independent of other (e.g. their parents or siblings). This, at the same time, also indicates that the role of the traditional TV set is changing. From the focus groups it seem as TV sets are mostly used as a "backcloth" for other activities (like

having the TV set running in the background while doing other things, e.g. home work) or for situations where the participants watch a specific movie or serial together with others as a social event.

Examples of video streaming include Karin (NL1) who tells that when she comes home from school, she typically first watches a TV serial on her laptop to relax before starting her homework. She watches a lot of TV serials on her laptop – especially English ones that are not on the broadcasting TV channels yet. Another of the participants in the same focus group (Catherine) explains that she does not watch much TV on regular TV sets, but she watches the programs she likes on her laptop. Another example is Simon (NL3), who tells that he hardly watches TV anymore, as he does not have his own TV set. When he likes to watch something, he either watches this with his parents (on a regular TV set) or watches it on his computer via the internet. He also makes a link to social media, as he thinks that his TV watching has to some degree been replaced by other activities like using WhatsApp, reading news on the internet or visiting Facebook to see if there are new messages or posts. Another participant from the same focus group (Noud) tells that he also hardly watches (regular) TV, but he usually plugs his laptop into the TV set and watch series or he watches them directly on his laptop.

A final example comes from the Danish focus group DK2, where several of the participants also use their computer to watch TV programmes. Safiye thinks that it is the most common (compared to watching TV programmes on the TV set), and Michael tells that it is easier to stream instead of having to remember to watch it on the TV at a specific time. Layla adds: "If it [a TV programme she wants to see] is on [i.e. that she can see it on the TV, when she want to see it], then it is on. If not, then I just see it on the web." Safiye uses her phone a lot for streaming TV programmes, and Amira adds: "Yes, if you can't be bothered with [*ikke orker*] turning on computers."

The TV programmes that they watch (on computer, telephone or "real" TV set) includes Cartoons/Disney Channel, Arabic TV serials and soccer. Layla and Safiye tell that during the Ramadan, many TV serials are running on the Arabic TV channels, and they explain that if they do not manage to see them on TV, they just watch them online (video streaming).

As these examples illustrates, video streaming seems closely related to convenience – including the convenience of not being dependent on others.

7.8 Acquisition and renewal of devices

Interestingly – and maybe a little surprising – the focus groups did not include many statements about the participants' aspirations for new devices (e.g. the latest smart phones or tablets). This might partly be due to the fact that most of the participants already own a smart phone. The discussion in one of the Austrian focus groups (AT2) might give a hint of possible explanations. The moderators question about how long the participants have their devices, such as smart phones, resulted in these responses (among others):

> "I don't think that at our age, we buy a mobile phone – and when it doesn't work anymore we buy a new one. Before it was like this: 'I need a new mobile phone' although the old one was still working – that's completely over now."
> (...)
> "I've had mine, I don't know, for two years now and it is already pretty damaged, the screen is cracked, the battery is empty within one day and I got no memory left. But I guess I still can make calls, I still got internet access and so I think why buy a new one as long as it's still working."
> (...)

> "That's maybe also because the parents say, yeah, if you need a new mobile phone you have to buy it yourself. The older we get the more likely we are to buy them ourselves."
> (...)
> "I think this also depends on, because nowadays we have mobile phones which you can do a lot with and before that you had mobile phones which you couldn't access the internet with and they didn't have all this and now you have everything and you don't urgently need an even better one. It's not worth six hundred Euros to buy a new one. So let's stick with that one."

The overall opinion seemed to be that the latest smart phone editions contain no revolutionary improvements that would make them buy them before their older editions are not working anymore.

These statements points at different possible reasons why the interest and aspirations for new devices did not seem to be in the forefront in the focus groups in general: First of all, many 16-20 year old persons find themselves in a situation where they have to buy their own phone (compared to when they were younger and their parents paid), and this might limit frequent renewal. Secondly, as the last quote indicates, since the introduction of the smart phone some years ago, there might not have been significant technical changes or "upgrading", as was the case with the shift from the "traditional" mobile phone to the "smart phone" (including internet access etc.). Thus, seen from the participants' perspective, the features related to the newest edition of smart phones do not differ much from those of smart phones bought a few years ago.

What the participants do with their old devices (e.g. mobile phones) when they buy new devices was only brought up in few focus groups. Among the exceptions is one of the Dutch focus groups (NL1), where the participants discuss recycling as an option. They are aware of the possibility of recycling old laptops and mobile phones, but are not very motivated to do so. Old mobile phones are handy to keep as a spare phone if one's current phone is broken. Also, the participants think that it is financially hardly worth to recycle:

> Moderator: What do you do with an old telephone when you think it'll cost me more to [i.e. that efforts of handing in the phone for recycling is not worth the money]...
> Loes: It's still in my drawer
> Karin: I've also got two old mobile phones at home
> Evelien: Yes it is always handy, sometimes when my phone doesn't work and I know that I can't use it for some time, it is always handy to know 'Oh I still have got an old phone that still works'.
> Karin: Mine are really broken
> Loes: Once I put one in a box for a kid in Africa that got this phone, but I'm not sure really how this works, but I also gave such a phone to charity.
> Karin: Do you think that really works? I don't think that it really goes to Africa, that a kid in Africa would really use it.
> Moderator: So environment is not really a thing?
> All (approving): No.

The habit of not handing in phones for recycling is interesting in an environmental perspective, as this can be seen as a disadvantage in relation to promoting recycling. Phones that are replaced by new ones are not necessarily technically obsolete, but could be used by others (second hand). However, if kept for a longer time, they will be even more outdated technically after some time and therefore perceived as less suitable for reuse.

The focus groups also include examples of ICT devices that the participants had acquired but did not use much. Examples are 3DTV, PS3 and – in particular – tablets. As Table 8 shows, half of the participants do use a tablet "sometimes", but about the half of them (54%) report that they use tablets for less than 30

minutes per weekday on average. In some focus groups, participants talk about having a tablet that they do not use much. An example is the following quote from the Norwegian focus group NO1 with participants from a vocational school (5 of the 9 participants report that they use a tablet "in general" in the questionnaire):

> Thomas: I have tablet, but I do not use it very often.
> Mats: Same here!
> Jens: I have an iPad.
> Moderator: What is it with the tablet you don't like?
> Mats: It's messy to work on. Big.
> Borge: I use the tablet just to listen to music.
> Thomas: I use it only when I'm lying down relaxing.
> Moderator: Messy, how come?
> Mats: I think that the tablet is big and ugly.The phone is much better.

It is interesting to notice how one of the participants (Borge) primarily use the tablet for music listening, while Thomas only use it while lying down relaxing. In an environmental perspective (taking into account the embodied resources used to produce and later dispose these devices), there seems to be a potential here for saving resources if this kind of acquisitions of devices hardly used could be avoided. In relation to this, the participants in the other Norwegian focus group with vocational school participants (NO2) point at the possibility of using smart phones for the same kind of activities as tablets (none of the participants reported to use tablets in general):

> Leon: (…) I can do the same on smart phones as on portable tablets anyway. And it [the tablet] does not go into your pocket. Shall I bring it with me in a small bag? That would be quite like having a personal computer.
> Øyvind: Depends on the smart phones.
> Stian: I have no need for a tablet! When we all have a pc and a smart phone then we have no need for a tablet as well."

Another example of purchases of devices rarely used comes from focus group DE1. One of the participants explains that he once bought a flat-screen TV with 3D and that this purchase wasn't really necessary. Afterwards he recognized that he only uses the TV little, maybe two hours a month. The TV is now placed in the living room of his parents. Also, last winter he bought a PlayStation 3, which he now rarely uses: "… now it is a chic blue ray player. For the three blue rays I own and the games gather dust." Furthermore, he owns two smart phones – one he uses for making calls the other one is used as an alarm clock.

The above indicates that there might be a potential for saving energy and resources by addressing the acquisition of new devices and raising the question of the relevance of buying a new device and/or identifying alternatives that might combine different usage features in one device (like the above example of the smart phone working as a tablet)

8. The link between ICT and energy and climate change

This chapter presents the findings in relation to the topic about the participants' conceptualisation, understanding and views about the connection between ICT and energy and environment.

8.1 Awareness of environmental issues in relation to ICT

In general, the focus groups show a limited awareness and interest in energy, climate and environmental issues related to ICT. The participants often found it difficult to elaborate on the links between their (personal) use of ICT and environmental problems – and in a few focus groups (e.g. DK2 and DE3) the moderators had to explain the link and concepts like energy and climate change.

Many focus group participants explained that they had never thought about the link before. For instance, in response to the question whether the participants in the Austrian focus group with general secondary school participants (AT2) reflect on environmental consequences in their everyday ICT use, the participants answer: "Hardly" and "I think that none of us really thinks about the consequences. Maybe we are somehow aware of it but we wouldn't switch off our mobile phone because of that."

In the German focus group with comprehensive school participants (DE3), the participants agreed on the point that they had never before thought about their own use of ICT as connected to climate change. The idea even appeared somewhat absurd to the participants:

> Well, so, if I now use IT, I have to say, honestly, that I am not worried about, or my thoughts don't even go to climate change. I don't see a connection… (Participant B3)

Thus, the question had to be clarified and further explained by the moderator because it was not correctly understood from the beginning. However, after the clarification it did make sense to them. Later in the focus group, a statement by the participant from before might indicate why the theme of ICT and energy/climate change is not in general in focus among the participants in this focus group (and young people in general). With regard to whether they are aware of environmental issues in general, she says:

> Well, no. No. Me and my friends we talk about, well I think this [ecology] is the least topic we would speak about. That is simply no topic for us. Just not an interesting topic for me. (Participant B3)

Another example of a focus group where the link between energy/climate change and ICT are not visible to the participants is the Danish focus group with participants from the Produktionsskolen (DK2). Here, most of the participants are uncertain with regard to how to understand the concepts of energy and (in particular) climate change. However, one of the participants (Shadi) explains it to the others – that it is "about CO_2 and all that stuff". Still, one of the participants (Amira) finds it particularly hard to understand and asks several times what is meant by "climate". When she finally (after other participants repeated explanations) seems to have grasped that it has to do with "the weather", she asks: "[But] What has the weather to do with an iPhone? (Several of the other participants laugh)".

Safiye tells that she does not think about climate change – and Layla and Amira do not think that it is something that interests any of them (i.e. any of the participants in the focus group). But when asked about the relation between ICT and climate, Safiye thinks that ICT is "bad for the climate".

It is evident that the participants in this focus group (like in several of the other focus groups) are rather unfamiliar with the discussion on climate change and the link between ICT and energy use/climate change – although most of them seem to have heard about climate change as part of the teaching in the primary school. Also, the concern for the climate does not seem to occupy them, overall, and they seem critical about the idea of changing their daily habits in order to save energy.

The participants in the focus groups in the Netherlands and Norway also found it somewhat difficult at first to see the link between ICT and environmental issues. In NO1, the participants found it difficult to see the

link and did not think of themselves as consuming much energy via ICT. Nor did the participants in the NO3 focus group know much about the link between ICT and environmental issues. Interestingly, this focus group indicates that a particular reason for the low awareness of environmental issues related to energy consumption might be related to the fact that the majority of the Norwegian electricity supply comes from hydro power (as described in chapter 4). As Kristian explains:

> I haven't thought about it in that way. We get our electricity from hydro power and in that respect it is environmentally friendly, isn't it?

A final example of the limited awareness of the link between ICT and environmental issues is the German focus group with vocational school participants (DE1). Like in the previous mentioned focus groups (and the focus groups in general), a personal connection between own use of ICT and energy consumption and climate change were not visible to the participants in this focus group. They agreed that they had never thought about this, though one explained that he had thought about it when he bought his new laptop:

> I have shortly thought about this after buying my new notebook, it has such an eco-function, when pushing the key it will save energy. But I switched it off directly because it is much slower and annoying and then I deactivated the key completely so that I will not use it by no means!

The moderator of DE1 later asked whether the participants had thought about environmental consequences of ICT more generally, and not only related to personal use. In response to this, one of the participants tells that they have heard about this during lessons in school on "globalization" in subjects like English and economics:

> …there it was mentioned, that rare noble metals are exhausted for mobile phones and computers and that people have to work there under inhuman circumstances, there (in these lessons) it is mentioned, but you see this, think about it for a short time and in the afternoon you already have forgotten it. It fades a bit into the background.

The moderator asked the participant, why he forgets it so soon and he tells that one doesn't feel responsible for it, because others also use their mobile phone too or even more than oneself. In this way, the participant brought up the question of "responsibility", which came up as a theme in several focus groups, and which will be explored further in next section.

Another of the participants in the German focus group DE1 tells that he knows from school of the bad production processes and confirms that this information does not influence his thinking very long, just like the previous mentioned participant did. And he adds:

> …after two or three hours, I start using my device again and everything is forgotten, that's crap, but I can't change anything about it, it is, the next one uses it and the other one uses it too, so oneself also wants to use it and well, if you don't use it, you get isolated. And then you are not a part of society anymore.

This statement clearly shows how strong a "need" the participants feel in relation to have access to and use ICT devices; like the social pressure described in chapter 7.

Apart from little interest in environmental issues in general, another important reason for the limited awareness about the link between ICT and environmental problems seems to be the "invisible" nature of the link between purchase and use of ICT and environmental impacts in general – and in particular related to the production and disposal of ICT devices as well as derived energy implications related to the use of the

internet. This is illustrated by one of the participants in the Danish pilot focus group with vocational school participants (DK pilot), Frederik, who explains that he thinks it is generally difficult to see the link between ICT and what is environmentally wrong or right:

> I think it is difficult as a consumer to make this link, because it is not a tangible thing – and even though the phone is physically tangible, we do not understand it as something physically tangible – we take it to be something personally...

Similar points are expressed by participants in the Austrian focus group AT2, who are not in general aware of the CO_2 emissions related to the internet. The internet as a technological infrastructure was more or less a black box for them. Thus, the CO_2 emission of the internet was seen as relative negligible. The participants' points of view were directed on the material devices they are using and less on the services in the background that make the usage of e.g. mobile phones possible. The fact that ICT is already the biggest single factor regarding the electricity consumption in Austrian households was surprising for the participants.

The Austrian focus group with two environmentally aware participants from a general secondary school (AT3) indicates that family background and socialisation can be an important factor for high environmental interest and awareness about environmental issues in general and in relation to ICT. Thus, these participants were among the few who described a clear interest in the subject, and they both referred to the influence from their mothers as being important for their own interest in environmental issues in general. For instance, one of them explained that her mother is a researcher within the field of mobility and that makes this a relevant topic at home. Furthermore, she is writing her specialising paper on climate change. Both participants in AT3 think that their classmates are not as aware of environmental issues as they are themselves.

Summing up, the focus groups shows that the awareness about environmental problems associated with ICT usage are very few – many participants even find it difficult to conceptualise the link between (their own) use of ICT and the environment. This said, several of the participants could see a link between use of ICT devices and (direct) electricity consumption. This was in particular evident in relation to their use of (smart) phones and their experience of having to recharge these often. Similarly, some had heard about energy consumption in relation to standby. In addition, a few had heard about environmental problems related to electronic waste (mentioned in the focus groups AT1, AT2 and NL1), the extraction of metals (including conflict metals mentioned in AT1) and energy consumption related to data centres etc. But these clearly belonged to the minority, and in most cases they did not think about the link between this and their personal use of ICT. Thus, it can be concluded that the awareness and knowledge are in general little, but with an exception in relation to the direct electricity consumption related to mobile devices in particular. Also, the focus groups with the most environmentally-interested participants (AT3 and NL2) show that even among this particular subgroup of young people, few think about ICT and energy consumption.

8.2 Relevant to save energy in relation to ICT?

In several of the focus groups, the participants questioned the relevance and importance of saving energy in relation to the use of ICT. In particular, many called attention to other consumption areas that they thought consume much more energy and therefore should be more in focus than ICT. Examples mentioned are neon signs (advertisements) in cities, industrial production in general, car transport, showering etc. Sometimes, the participants also refer to other countries (e.g. USA), which they think consume more energy than their own countries and therefore believe should feel more obligated to save energy than themselves.

An example is the Danish focus group DK1, where one of the participants thinks that other parts of the world are polluting more than Denmark and points at Asia and their use of nuclear power ("and that pollutes the environment extremely"). Another example is the following first responses in the Austrian focus group AT1 to the theme about personal use of ICT and energy/climate change:

> Everybody knows that [ICT] takes an extreme amount of energy. And it takes up a relevant amount of energy consumption worldwide. But honestly: Before cutting on the network of the world one should start cutting on luminous advertising or the like. Or on industry and take a look at that instead of making people use the internet less in order to save energy because, compared to Japan and their luminous advertising – that's a far bigger amount. And, honestly, I find the internet more important, for me personally at least. (Participant E)
> (...)
> I think the whole IT-thing, the energy consumption I mean, if we start to intervene there for environmental protection, I think that's a drop in the ocean. I don't think that this takes so much energy or, whatever, that we have to produce non-renewable energy for this – I don't think that this is so much, compared to fuel, I guess. (Participant B)

The experience that the potentials for saving energy through changing one's own use of ICT are few ("a drop in the ocean") comes up in several focus groups. In addition to the above example, other examples are NO3 (where the participants think that one person cannot do a great difference) or the NL2 focus group with environmental students, where one of the participants (Jinka) uses the exact same phrasing as above, as she thinks that all campaigns to make people aware about e.g. sorting garbage (in plastic and non-plastic) and using energy saving light bulbs instead of the old-fashioned ones are just a "drop in the ocean". Besides, things can much more easily be solved technologically, she thinks.

The understanding of ICT as having a limited impact in itself on energy consumption and climate change or being overshadowed by other consumption areas with much higher energy consumption also seems to influence their own motivation to change habits and save energy in relation to ICT. Many participants do not feel personally responsible for the environmental problems related to ICT and identify other actors who they think should be the proactive in relation to find solutions. An example is the following quotes from the Danish pilot focus group, where Frederik says:

> I think that as a consumer of the products that are available – whether it is Vimeo, Youtube, Facebook and so on – I don't think it is our responsibility whether we are running the server hard or not [i.e. consuming much or little energy]. There – on the other hand – I think it is the provider's responsibility to make the programming of the different services more energy friendly. Because, essentially, it is there the problem arise, if it is complicated coding they have made.

Frederik goes on with telling that he has read a newspaper article about how Facebook has difficulties with recruiting qualified staff – and how this is related to the messy programming of their applications. He continues:

> You might say that we – as consumers – have to have a blind trust in [rely completely on] that what we use is a good product – because it is not like picking up a melon from the refrigerated counter in the fruit and vegetables [section of the supermarket] and see that it is nice – or that it has the organic label. We just can't do it in the same way with the things that are happening interactively, or how to put it. It is probably more the providers – the companies – that should do it more energy friendly.

There seems to be general support for Frederik's statement among the other participants, and Sebastian adds that there is also a need for more "green electricity".

In this way, many participants think that the main responsibility for reducing the environmental impact of ICT should be on the providers and designers of the technologies. Also, several participants talk about "green electricity" as a solution – and in this way allocates the responsibility of solving the problems to the energy providers. Overall, the trust in technological development as the main approach to reduce environmental impact of ICT seems to be widespread among the participants. In this way, they seem to have confidence in technological solutions as a way to save the energy and climate-related problems of ICT usage. This can be seen as part of the reason why only very few participants feel a direct, personal responsibility for saving energy in relation to their own use of ICT.

8.3 Specific knowledge about energy and ICT

With regard to the participants' level of specific knowledge about how much energy various devices and uses of ICT consume, we find that many focus groups are able to establish some general and valid observations on the basis of their discussions. At first, this seems a little surprising taking into account their limited general awareness about this subject. But as we will explain below, some of this specific knowledge is related to personal and often physical/tangible experiences from the participants' own use of ICT (among other things).

In general, the participants identify (correctly) desktops/laptops and TV sets as well as streaming and gaming as belonging to the group of most energy consuming devices and activities. Some focus groups also make the observation that it is "processor demanding" activities in particular that entails a high energy consumption. As shown later, the participants' specific knowledge is mainly based on their practical experiences (e.g. with devices becoming warm or activities that shorten the life-time of a battery charge), but sometimes this kind of "practical knowledge" also results in incorrect or misleading observations. For example, the participants in the Danish pilot focus group conclude that internet services run on a computer are less energy consuming than on a smart phone. A misconception which is likely to be a result of their experience of smart phones quickly running out of battery if used for some specific internet activities, whereas the desktop does not run out of battery as it is plugged in all the time. Also, portable devices are typically held in the hand, and one can therefore feel the electricity consumption as heat – i.e. the device is being heated. In comparison, the use of laptops/desktops does not involve the same palpable experience of energy consumption. In this way, the electricity consumption related to laptops and (in particular) desktops is less visible compared with the electricity consumption of mobile devices with batteries. More generally, there is a widespread lack of knowledge about embodied or internet-related energy consumption, which – again – can be seen as a result of this being less "tangible" as compared with the direct electricity consumption of devices.

As described above, desktops/laptops and TV sets are in general identified by the focus groups as the most energy intensive ICT devices. In addition, some focus groups actually mention the internet as energy consuming (e.g. all the Austrian focus groups). However, in general, the focus is on the power consumed directly by the devices. An example of how the focus groups discussed the energy intensity of different ICT devices and uses are the Dutch focus group with educational science university students (NL1): The participants in this focus group mainly think of saving energy when asked about environmental effects of their ICT use. They are aware that some uses of ICT use more power than others as they experience that their equipment runs out of energy. For example, Loes tells:

> With mobile internet on your phone you need to charge it much more often and that doesn't seem good to me. I had this mobile without internet and then I could use it for a week. Now I can use it only for one day [before having to recharge], you use a lot more power.

In general, the power indicator on their smart phone is an important information source. Through this, some discovered that "graphics or everything to do with video are very bad" in terms of energy. Karin says:

> If you play a game or watch a movie on YouTube, immediately 10-15% of your battery is gone.

In general, the focus groups include several examples of similar experiences with activities that uses much energy on smart phones. Thus, in one of the other Dutch focus groups (NL2), Jan says:

> Also You Tube costs a lot of your battery: when I listen to music on my smart phone via You Tube then it is empty in the blink of an eye. That really goes fast.

The focus group with educational science student (NL1) furthermore shows how the heat that radiates from ICT devices equipment gives information about the intensity of energy use (as mentioned in several focus groups), although this seems a less reliable information source:

> Evelien: I think the televisions of nowadays use much less energy
> Loes: but it becomes completely hot if it is on for a longer period of time
> Karin: but that is also true with a laptop, the storage battery of your laptop also gets super hot
> (…)
> Tiffany: but also your telephone, don't forget!
> Karin: not mine actually, with a game console that is also not very bad
> Tiffany: I think that that will also use a lot of power, nowadays, they make it just like real and then I think it costs a lot…

Another point that these students consider to be relevant in terms of taking care of the environment is shutting off their equipment (including not leaving it in standby mode) and not letting the charger charge unnecessarily long, although not all are equally convinced of its importance:

> Karin: when I wake up in the morning I take my phone out of the charger, only, sometimes, I forget my charger in the plug and then I come home and I think, wait a second, it is still in there
> Loes: I don't think that matters
> Karin: well, yes, I do the same thing with my laptop if I take my laptop off the charger I leave the charger in the plug
> Evelien: it will, in principle, still cost you energy
> Catherine: is that much?
> Loes: I think it is really not much nowadays, with all those super modern machines
> Evelien: that I don't know really
> Loes: I always take it out. Most of the time
> Evelien: do you always take it out?
> Catherine: yes, I am a virtuous girl, my dad became angry about this very often, so now I just listen to it.

This focus group also discuss the importance of recycling old devices.

The Danish pilot focus group makes another example of the focus group discussion on differences in energy intensity of ICT devices and uses. In relation to the exercise with placing cards with devices and uses in order of energy intensity, the participants start with suggesting that stationary PCs (desktops) and PlayStations (game consoles) are the devices that consumes most energy. Bianca suggests that laptops also belong to group of devices/uses with the highest energy consumption, but Morten thinks that laptops do not use as much as one might think. In reply to this, Frederik states that laptops do use rather much energy, especially because "there is limited space that needs to be cooled".

Sebastian suggests that televisions do not use much electricity anymore – compared with the "picture tube" (CRT) television sets ten years ago.

Lisa points at the card with the (traditional) mobile phone and suggest that it uses little energy:

> Lise: An old telephone can keep at least one week [suggesting that it can run a week on one charging]
> Morten: Yes, (...) but nobody says that that one [the model on the card – a Nokia phone] can keep electricity better – because it is an older model – than for instance an iPhone.
> Frederik: [Objects] Yes, I would think so. The components that are inside it use less electricity. There [on smart phones / newer mobile phones] you run a network that is called either 3G or 4G – those systems use generally more electricity than the old GSM's.
> Morten: Well, okay. Yes, that I have no idea about – once it gets [too] technical.
> Sebastian: It depends on how fast and how close the radio waves are on each other – depending on which frequency they run.
> Frederik: That one [the Nokia phone], that's actually just a walkie talkie multiplied by two. It is two walkie talkies in one, it is a mobile phone from old days. It belongs to the lower end [of energy consumption], and that [the Playstation and the stationary PC] is the upper end ...

In the following, the group discusses how to place the remaining cards between the lower and upper boundaries of the energy consumption scale. Sebastian suggests that Netflix (video streaming) and games use much electricity:

> Frederik: (...) if I'm streaming on my phone, it really takes a lot of electricity. Also if I just play Castle Tower Defence – that I'm just crazy with – but I was sitting and looking at it just before [he had just checked his phone's data about its energy consumption?] – that I have now spend 20 per cent electricity on my [phone /thc] [means that he has consumed 20% of the phones battery capacity since last recharge], and of these 20 per cents the game has used 30 per cent of all the electricity – and I have been playing for a quarter of an hour. So, these kinds of things, they are just drawing much electricity on the phone.

Frederik suggests that "virtual world" games belong to high energy consumption. Sebastian thinks that televisions do not consume much energy – "Well, I don't know what televisions are using – about 400 watts, I think – they are not using so much". [400 watt is actually quite a lot for a television set]. Frederik [correctly] adds: "But it also depends on whether it is plasma or LCD et cetera". Sebastian is not so sure: "No, I think that it actually has to do with the colour values on the screen".

The group discusses whether online games use more or less energy than offline games. Frederik suggests that it is the graphics that are the important thing: "It depends on the graphics – it is the graphics that almost dictates how much electricity a game uses."

Besides the importance of graphics (how "heavy" the graphics are), the focus group also seems to reach a consensus on that ICT uses with streaming involves higher energy consumption than ICT uses without streaming. Sebastian adds: "For instance with Netflix – the better internet [connection] you have, the higher is the quality that you are streaming."

About the differences between smart phones and laptops, Bianca says:

> It is actually easy to see on your phone [how much energy it uses], because there you keep an eye on how much electricity there is left, because it dies [goes empty of electricity on the battery]. But the laptop is just normally plugged in – and the stationary [computer] is also plugged in.

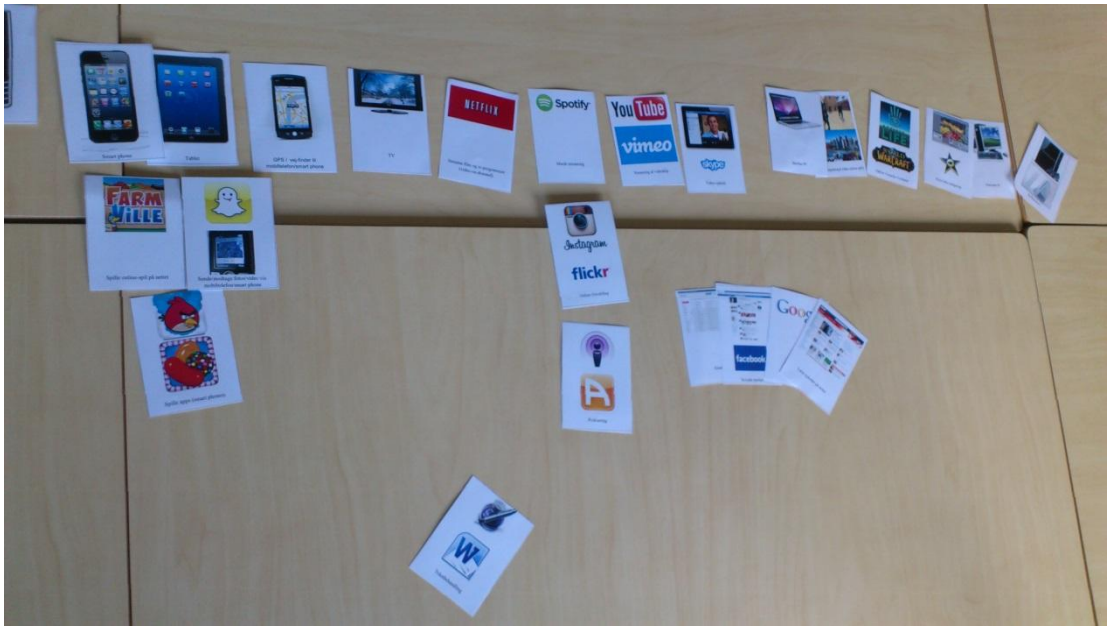
There is some confusion with regard to whether wi-fi uses more or less energy than mobile broadband (2G and 3G).

About the energy consumption related to video streaming (Netflix) on tablet, some of the participants discuss:

> Sebastian: Also, if you are streaming Netflix, for instance, on your iPad, when you can indeed feel that – if you are running HD – that it gets hot on the backside, because it works. And heat is also energy, so it must also use some energy.
> Lisa: Does it have to be HD – when an iPad is so small?
> Morten: Everything has to be in HD.
> Lisa: Okay.
> Morten: (...) You can feel that it is hot on the back side. I can also feel that on my phone if I'm playing, for instance, or streaming. (#2 - 00:15)

The participants often use mobile broadband – especially in school because it is difficult to log on the wi-fi in the school.

The outcome of the exercise with sorting ICT devices and uses in order of size of energy consumption



As illustrated by the examples above, battery life-time and the heat production are two very important sources for the focus group participants' knowledge about the power consumption of different devices and uses of ICT. In many cases, this gives a reliable and valid insight into differences in energy intensity, but as already pointed out, the practical experiences with ICT and energy consumption is also misleading in particular two ways: First of all, the tangible experiences of energy use are limited to the direct energy consumption of devices and do not include other types of energy consumption like embodied energy or derived energy consumption in the internet infrastructure. Secondly, as experiences of heating and short battery-life times are mainly associated with the use of (small) portable devices, the energy intensities of other devices like laptops and (in particular) desktops might be ignored. However, it is an important finding

of this study that young people actually do have some (in many cases valid) knowledge about ICT and energy consumption through their practical and "physical" experiences with their use of ICT devices. This could be an entry point for raising young people's awareness of ICT and energy consumption and a starting point for discussions about ICT and energy.

8.4 Sources of information

As already described in the previous section, the practical experiences related to heat and life-time of battery charges are important sources of knowledge about ICT and the direct energy consumption of devices. However, the focus groups also point at other important sources of information – although these sources often seem to be mostly about more general environmental issues.

One important source, which comes up in several focus groups, is the school. For instance, in the German focus group with vocational school participants (DE1), one of the participants tells that they have heard about problems of health and environment in relation to the extraction of rare earths used for mobile phones, but "you see this, think about it for a short time and in the afternoon you already have forgotten it. It fades a bit into the background." (cf. the same quote was also used in previous section on awareness of environmental issues in relation to ICT). That the information "fades into the background" again seems related to the previous described finding that the participants in general were not particularly interested in environmental issues. Some were also critical about the level and quality of the information that they got through school teaching. In the German focus group DE2, the school that the participants came from was even mentioned as a negative example, because it promoted the use of ICT in general and did not offer alternatives:

> B1: Um, I have to simply say that we are completely trimmed on information technology there [at school]. That we are dependent and so on. It is not really being clarified to us. It is not such an important aspect and among each other we don't talk about it at all. It is not so immediate for us. […] And in general, that is – we are the generation "Who cares what happens, after we are gone" a little bit. We know about climate change, and that it is happening anyway, so it doesn't matter anyway, and yes. [...] Anybody contradicting?
> All in unison: No.

Thus, even though the school are mentioned as a source of information about environmental issues more generally, the school does not generally seem to be a source for information about specific environmental problems related to the use of ICT. Additionally, the general lack of interest in environmental issues also seems to work as a barrier to many in terms of learning about these issues.

Another source of information, which is mentioned in some focus groups, is popular TV science shows This source of information is mentioned in some of the Austrian and German focus groups. For instance, a participant in AT2 mentions the German popular science show "Galileo". In the German focus group DE3, popular TV science shows about technical and environmental issues are described as appealing. In this focus group, TV seems to be an important source of information about these topics.

Finally, some participants also mention their parents or the internet as sources for information. This is particularly the case in relation to specific advices on how to save energy (e.g. advices on avoiding standby consumption by turning off devices when not used).

All in all, the sources of information about ICT and environment seem sparse and often with limited (if any) particular influence on the focus group participants' knowledge about the issue. As a result, the before-mentioned practical and tangible experience with ICT and (direct) energy consumption seems to be the most

important source of knowledge about ICT and environment among young people. However, the participants do not in general seem to reflect upon their use of ICT and energy consumption, and therefore, the practical knowledge about energy consumption seemed in most cases not to be "evoked" before the issue was brought up in the focus group setting.

9. Change use of ICT and saving energy

This chapter analysis the focus group participants' thoughts about changing their use of ICT in order to save energy.

9.1 Willingness to change practices?

As the previous chapters already have indicated, the willingness and motivation among the focus group participants to change their use of ICT in order to save energy is in general very moderate. In most focus groups, consensus seems to be that they will not change their practices – or that there is only some motivation for smaller changes (such as turning off equipment if not used). There seems to be a widespread consensus across focus groups that only if energy saving habits do not involve too much efforts and do not compromise the convenience of using ICT, they might think of this as a possibility.

One example of the responses to the idea of changing practices in order to save energy, one participant in focus group DE1 thinks that saving energy "makes no sense" and with regard to changing his user practices: "By no means!". More positive responses can be found in one of the other German focus groups (DE2), where it seems to be conceivable for the participants to change their behaviour to a small degree (they list examples like switching of devices instead of leaving them in standby and reducing the smart phone to a "small" mobile phone with reduced functions).

In continuation of the previous description of how many participants think that the potential for saving energy is limited ("a drop in the ocean"), some participants justify their limited willingness to change practice by referring to the limited impact this would have on the total energy consumption. Also, inconvenience was often mentioned as a reason for not changing practices. For example in the German focus group DE3, where the participants admitted that despite better knowledge, they would not take the battery charger out of the socket, even if not charging their device, and even though they knew about a risk for fire. One girl also said that her mobile phone had a reminding function and that it would actually remind her of taking the charger out of the socket, but that she would not do so. It would be so convenient to have it ready just there. As one of the participants says: "I believe it is this laziness for us all. That you think that if you have the plug ready there and then, wham, and then it goes." However, later in the focus group, the participants seem to agree that if more information was available, and if it was not too inconvenient, they might consider changing practices.

Similar results were found in the focus groups in the other countries. For instance, in Norway, the focus group participants did not generally find it relevant or motivating to change practices. When talking about changing practices in order to save the environment, they would rather talk about recycling waste, less car driving and choosing public transport.

Even though most participants were critical and reluctant to the idea of changing practices, it is important to notice that many also came up with specific ideas on how one could save energy (see following sections) as well as some also expressed a positive attitude towards changing their own practices, if only this would not be too inconvenient and if they had the information needed. For instance, in the Danish focus group DK1, several supported the idea that if people were better informed about the energy consequences of ICT, they

would change their user pattern and save energy. However, it is also stated by some that people already know that ICT consumes energy – and in despite of this, people do not save on the energy consumption. But they think that maybe the reason for this is that the main focus in relation to energy saving has not been on ICT in general.

> Clara: Well, people already know the things about switching off the light and that they should wash clothes at a lower number of degrees and things like that. I think that with IT, one could really do much more in order to increase awareness about this.

Another participant, Sarah, mentions that many of her friends live in homes with many television sets that are often turned on at the same time. She thinks that there is a large potential for energy saving if people started to turn off their TV sets. Morten and Mette add similar stories about families they know with a lot of ICT equipment that is running all the time.

However, when asked later by the moderator whether there is something that they would personally do (differently) in order to save energy in relation to ICT, this gives the following responses:

> Mette: We cannot change that, really.
> Moderator: Why not?
> Mette: We have to use it [i.e. ICT].
> Sarah: We have to use them [IT devices]. We use them for home work and at the school.
> Rebecca: And for doing home work. So there is not much to do about it.
> Morten: You could do it [i.e. live without ICT], but then your everyday would be just like... (...)
> August: No, but that thing about just sitting and watching movies on YouTube – that's just how it has become – and visit Facebook. Well, I don't know – my everyday would be odd without that, I think.
> Several of girls: Mmm. Yes.
> August: It is a giant part of it – I couldn't imagine it at all – that it wasn't there.
> Rebecca: But I also believe that it's like connected with that – when you do homework, and then have just a little break – and then you are just out [probably referring to looking at Facebook etc.] – and then you return to it [the homework].
> August: Yea yea, exactly. (...)
> Moderator: But do you all feel it in the same way?
> Anders: Yes, it's just turned on
> Mette: It is just there.

Thus, most focus groups are capable of identifying potential ways to save energy – at the same time, they are in general critical about whether this will be done in practice due to problems of inconvenience etc.

Many focus group participants point at the financial aspect (saving money) as what they think would be the main motivation for saving energy in relation to ICT. At the same time, they also often note that as they are still living at home, saving money is not a motivation in their own case. However, a few of the participants describe how their parents sometimes remind them of saving energy (e.g. shutting down computers when not used), and they think that this is about saving the energy bill. Similarly, some think that when they move from home, they will be more interested in energy saving as a way to save (their own) money.

Finally, several focus groups are also making points about how changing ICT user practices in order to save energy would be an "upstream" experience. As described previously, the participants to a high extent feel a "social pressure" from their peers and others to participate in e.g. social media in order to be included in the "communication circles" and to be always online and connected. Changing practices and "opting out" would, they think, be difficult and involve personal costs in relation their contact to friends etc. Also, if everyone

else around you are continuing their usual ICT user patterns, this would make it particular difficult to change practices and, for instance, keeping from doing certain things like streaming etc. The following examples from the focus groups illustrate the participants' thoughts about challenges related to change practices in relation to ICT usage.

A participant in the German focus groups with comprehensive school participants (DE3) draws an interesting analogy between changing ICT use and being on a diet (e.g. a slimming diet). The participant refers to her own situation as living at home together with her family:

> Because, we really are six at home, six persons and if you now start to pay attention to something like that [change use of ICT in order to save energy] then everybody has to be willing, to pay attention, you cannot pay attention alone. There you must, it is like with a diet. Well, for example, if you – well, I wanted to start a diet once, but if you live in a house with other people, who do not go on a diet, then you can't make it. I think. You have to be ready to do it all together, alone it does not work somehow.

The quote illustrates why many young people may find the task of changing everyday use of ICT to be almost insurmountable if thought of as an individual and personal task. This also indicates that it might be better – in general – to address the question of saving energy in relation to ICT as a collective task rather than an individual task. Or at least to address the collective nature of ICT use and how this influences the possibilities for changing practices.

Other examples of "upstream" descriptions come from the Danish focus groups, where some participants described how it is difficult to change ICT use as ICT is an integrated part of everyday life. In the Danish pilot focus group, Frederik states that it is difficult for the consumers to change their use of ICT and that one explanation for this is that ICT has become a very "integrated part of our everyday". This also refers back to a point about how integrated ICT had become in our everyday lives (referring specifically to the mobile phone) that Frederik made in the beginning of the focus group:

> Frederik: But it is also difficult [to describe what you are using your phone for] because one's mobile phone today – contrary to ten years ago when I got my first telephone – is much more your whole life. It is actually very personal things, and I don't think you think so much about all the things you are actually using it for. You know, it is everything from stop watch for cooking eggs to checking how the weather is – so it is an integrated part of your everyday, while before you used teletext or the internet [he seems to mean accessing the internet via the computer] in general to get this information. Now, you've got it all to your hand – so I believe that we are using it for much more than we are actually thinking about.

Similarly, the participants in the Danish focus group DK1 did not see much possibility for changing their personal behavior and pointed at problems of "lock-in" (see previous quote in this section from the DK1 focus group).

The focus groups indicate that this experience of not being able to change practices without personal costs can explain why some participants feel a schism between having knowledge about environmental problems related to ICT and – at the same time – not feeling able and/or willing to do something about it personally. For instance, the environmentally-interested participants in the Dutch focus group NL2 admits that they would probably not change their personal use of ICT – even if they knew that some uses were more energy intensive than others. One example is Mirjam, who does not believe that young people are willing to change their behavior because they are too attached to their ICT devices: "If they would know that e.g. online gaming uses the most energy, I don't think that anyone would care about it". When asked by the moderator how this would be for more environmentally conscious young people like the participants in this focus

group, Mirjam states that this would also apply to herself; if, for instance, streaming movies turn out to be "bad", she would not reduce the amount of movies she would watch.

9.2 Existing energy saving practices

It is interesting to observe that even though the general interest in changing ICT user practices in order to save energy is (very) scarce, most of the focus groups include descriptions of how the participants have developed habits or strategies to save energy – especially in relation to their use of smart phones. So while the participants do not express a general interest in saving energy for environmental reasons as such, they actually already do many things in order to prolong the life-time of battery charges. Examples are: Closing down rarely used apps, turning off mobile broadband, reducing the brightness of the screen or installing energy-saving apps on smart phones in order to save energy and battery. One example is a participant (Lisa) in the Danish pilot focus group, who tells about an energy saving app (called JuiceDefender) that she has installed on her Samsung Galaxy S2 smart phone, which turns down the light on the screen and turns the wi-fi on and off depending on the need for internet access. She bought it in order to make the battery on the phone last longer between charging. Lisa: "If you use it, when it [the battery charge] last four days, but if it has to get on the internet, when it uses a lot of electricity. When it only lasts two days or so." Lisa's story about the energy saving app brings about some interest from several of the other participants. For instance, Bianca is surprised that Lisa's phone can run four days on one battery charging.

Even though the main focus seems to be on saving energy on smart phones in order to extent the battery life-time, the focus groups also include other examples of participants with energy saving practices. Thus, a few participants explain that they use (or have used) energy saving features on their laptops. Typically, this is also about extending the life-time of battery charges. Again, the Danish pilot focus group includes an example of this:

> Frederik: I have an energy-saving feature on my laptop, which I use… it's called Asus Leaf, I think. It's like a leaf, where I have to choose between different points on the leaf – according to how much energy it should use. So, if I'm going to sit and work with heavy things, it turns down the consumption for all the other programmes, which are running in the background and so on. So, it reduces the electricity consumption and I can see how much the electricity consumption is – and I can see how many trees I am saving and bla bla bla. So I get a morality boost there, even though I suppose it is not that true what it says.

However, the focus groups show mixed experiences with this kind of eco-saving programmes on laptops. For instance, a participant in the German focus group with vocational school participants (DE1) has tried an eco-function on his computer, but turned it off again as it made the computer slow.

Another example of energy saving habits (mentioned by a few) is using multiple sockets with switch to avoid standby loss. The above-mentioned participant in DE1 who had tried an eco-function on his computer explains that he turns off the devices and uses a multiple socket, with an on/off button, which assures that no energy is used when the computer is not working. Asked why he does so, he answers: "I don't know, it's because my parents do so and so we all do it like this!"

Finally, some participants explain that they normally switch off their TV sets for the night – but typically not in order to save energy, but for other reasons like avoiding an annoying humming sound or light from the television during the night (which would disturb their sleep). Also, the participant Frederik from the Danish pilot group explains that his girlfriend has taught him to turn off standby consumption of their television set and other things at home. But he notices that he does not do this at school; he do not care, as it is "the

company who pays" (i.e. the energy bill is paid by the school), but "at home, I just do it without thinking about it". Frederik thinks that it is mainly to save money and less because it is "good for the nature".

9.3 Ideas on how to save energy

The focus groups did come up with a number of ideas and suggestions on how to save energy in relation to the use of ICT. In the following, we will describe these ideas briefly and illustrate them with quotes from the focus groups.

Promote repair instead of replacing

The idea of promoting repair of ICT devices instead of replacing came up in some focus groups. Here, several focus groups participants point at the problem that repairing devices is often more expensive than buying new ones. Several participants also criticise the short life span of ICT devices in general. For example one of the participants in the Austrian focus group AT3, who confirms that that the price of the devices (she refers to her mobile phone) is most important for her because she does not have a lot of money. She bought her current mobile phone second hand from a friend. She criticises the short life span of devices like mobile phones, computers or printers and that fixing them costs almost as much as a new device. She tells about her family's old CRT-TV which lasted 15 years whereas the new one (flat screen TV) already caused trouble within the first half year. She also gives the example of Apple products and how devices from other companies actually get repaired – while it seems that in most cases with e.g. iPhones a new device is sent back rather than an old one repaired.

The idea of repairing instead of replacing also came up in the German focus group DE1. Here, the participants also discuss whether it is more expensive to repair devices instead of buying a new one. One of the participants (B5) thinks that it is simply not cost efficient to repair e.g. the display of a Samsung S3 because the display would cost more than a used S3, so it is not profitable. B5 is himself involved in a repair café, where he and others help people repairing their devices. The discussion of repairing versus replacing reminds another participant (B4) that his current computer actually consists of about 50% of his old one, while the other 50% were put together from old parts of B5's computer and some new bought parts. In this sense, this represents a way of repairing and reusing used computers instead buying a new one – although B4 and B5 did not in the first place think of it as an environmental-friendly method.

Is new ICT really necessary?

Some focus group participants also raise the question whether acquiring new ICT devices always is necessary. Alternatively, one could use devices for a longer time and in this way save the environment. This also relates to what some focus groups discuss as avoiding "unnecessary consumption". An example of statements related to this solution comes from the German focus group DE1, where one participant (B1) explains that he owns an iPhone 4, which is sufficient for him although the processor is not that fast anymore. He would like to have a new one but is also still satisfied with his current one. As a more general observation, he adds: "Some people always want to have the newest gadgets, that's simply a fact!" Another participant (B2) admits that he would be happy, if he could always own the newest model, but that it is also not a problem not to have it:

> I have to say that I allowed myself the iPhone5 last Christmas, because I simply liked it and I wanted it. I had the iPhone4 before, and two years had passed and I thought it is okay to get a new one. I don't need a new one every year, but every two, three years I think it is totally okay.

As these statements illustrates, there seems to be a potential for prolonging the use-time of ICT devices if a more "reflexive" approach to buying new devices could be promoted.

Promoting correct disposal of ICTs

Correct disposal of ICTs is brought up in some focus groups. Here, focus is on how to promote that used ICT devices should be delivered for recycling/reuse instead of being dumped in the dustbin. This topic is discussed in detail in the Dutch focus group NL1, where the participants seem to agree that the environment is an important concern and motivation for delivering used electronics to reuse/recycling, even though they think that money received for correct disposal would be an even more important motivation.

Avoid standby power consumption

The idea of avoiding standby power consumption in relation to computers came up in many focus groups. The focus groups show that it is a widespread practice among young people not to pwer down the computer between uses. Instead, most participants seem to use the sleep mode of the computer – typically by just shutting down the screen when they are not using the computer. As discussed previously, this relates closely to the convenience of not having to wait for the computer to starting up again after a complete shutdown.

Overall, many participants seemed positive towards the idea of avoiding standby power consumption, but at the same time they typically pointed out a number of reasons why they did not avoid it today (and also possible "barriers" for making them change their habits). The main obstacle for changing habits seems to be the potential inconvenience of shutting down computers (and televisions etc.). The most frequent mentioned inconvenience is the one of having to wait for the computer to start up again after a shutdown, while a few also mentions that some devices are not made to be switched off (e.g. the clock on Sony PlayStation).

Avoiding standby power consumption seems to be a promising area to focus on in relation to promoting energy saving as the young people both seem somewhat positive towards the idea and as many already know that there is a "waste" of energy associated with leaving devices in standby.

Use less ICT in order to save energy

The idea of reducing the use of ICT (e.g. spend less time on Facebook or streaming fewer movies) came up in some focus groups. Even though most focus groups were reluctant towards this idea, some also associated it with the previous mentioned critique of possible negative impacts of ICT use in general (e.g. that mediated interaction via ICT might be less "authentic" than "real", physical co-presence).

However, the critical view was the most widespread, as doing with less ICT usage was associated with loss of convenience. The discussion also often ended up in a kind of "live with" or "live without" ICT – showing only a little room for middle-positions. This indicates that ICT belongs to the core of modern everyday life for this age group (as for most other age groups probably) and that questioning the extent of ICT usage is like questioning their way of living. For instance in the Danish focus group DK1, the idea of reducing ICT usage was associated with "going back to when one's parents were children".

Other reasons for why it would be difficult to reduce the use of ICT as pointed out in the focus groups include the previously mentioned social pressure (and associated "upstream experiences") and the point that it is difficult to "step back" when you have first experienced something new (e.g. having internet on your mobile phone).

Despite the general resistance towards reducing use of ICT, there was also (as mentioned above) some participants who suggested a more "reflexive use" of ICT. One example comes from the Austrian focus group AT3, as one of the participants suggests a more "reflected" use of electronic devices – she criticises the tendency of aimlessly surfing the internet only to pass the time. She expresses this also in a self-critical way, as she observes this behaviour with herself.

Using fewer devices by doing things together or avoiding multi-tasking

Some focus groups came up with the idea of reducing the number of devices used at the same time – either by doing more things together with other people (e.g. watching TV together with family or friends instead of watching it alone) or avoid multi-tasking involving several devices at the same time.

The first idea (doing things together with other people) typically relates to the critique of ICT as separating people. For example, in the Austrian focus group AT3, one of the participants thinks that unlike in her own family, many families have a simultaneous use of electronic devices: One person watches TV while another one uses the PC and another one does something else with another device. She thinks that it would make sense that people do more things together, like watching TV, instead of using many devices at the same time. More generally, she suggests that people should go out of the house more often and that families should do more things together. The other participant in the focus groups agrees that "being together" seems to be challenged by the simultaneous use of different devices. She tells about her own experience with her siblings and parents:

> "I see that with my younger brother. He sits around with his iPhone and plays a game and next to him my father who is […] reading the newspaper and there is zero contact between them and you realise, okay, he's totally immersed in his device. Even though there is only half a meter distance between them but there is no communication at all.

Both participants agree that the intense use of smart phones cause a loss in the everyday life of families.

A similar story comes from the Danish focus group DK1: One of the participants (Sarah) mentions that many of her friends live in homes with many television sets that are often turned on at the same time. She thinks that there is a large potential for energy saving if people started to turn off their TV sets. Morten and Mette add similar stories about families they know with a lot of ICT equipment that is running all the time. Sarah also points at another (indirect) benefit of having fewer television sets in a family: From her visits at her friends' homes, she has experienced that they often end up with sitting in her friends' room and watching television. In her own family, they like to stay in the living room (her mother and her siblings) – it is like the centre of the home. Sarah thinks that it is "irrelevant" with all that ICT. Mette agrees with Sarah and calls it "unnecessary".

Alternatively, the number of devices used (at the same time) can be reduced by avoiding multi-tasking. This idea was discussed in the Dutch focus group NL1, where one of the participants (Evelien) suggests that she could use fewer devices at the same time. Catherine agrees and says:

> Catherine: Or just pay attention to the lecture and not at the same time use Whatsapp and Facebook.
> Karin: And when you're at home not use your TV and your laptop and your iPod and your phone on.
> Moderator: But it's nice too, otherwise you wouldn't do it?
> Evelien: I do it more because it's easy. But it could be fewer at the same time, or shorter in time.
> Moderator: What would be a motivation for you to do that?
> Evelien: Good question, No idea actually.
> Moderator: how about you [the rest of the group]?
> Loes: If it would be clear what is going on, then you can think 'oh yes, I'll have to do something about it'. Now that isn't clear, you know.
> Karin: Now it's very vague. It's kind of abstract how much power you use for something. If it would say like for 10 minutes of internet use you use this amount of energy then it would become a lot more clear. I don't know either how much energy I'm using with everything I turn on.

> Sandra: And what it stands for, it can say how much energy you use but well, like how many poles will melt or something?"

They realize they could use less equipment at the same time. But they do not know why or when they would be motivated to actually change this, as they think they need more information about the consequences. Thus, the discussion above also points at a need for more information about environmental issues related to ICT.

More information about ICT and environment is needed

Several focus groups identify a need for more information about the negative influence of ICT usage and also recommendations on how to reduce the environmental impact of using ICT. For instance, this could be information about negative environmental effects related to the manufacturing of ICT devices or the energy consumption related to the use of the internet. Also, there is a need for more information on *how* to save energy – but this should preferable be specific and tangible advices (rather than general or abstract recommendations) on what to do. Also, these advices should not be too inconvenient to follow.

For example, the German focus group DE3 agrees on the point that if more information was available, and if it was not too inconvenient, then the participants think that a behavioral change might be considered. Similarly, the Dutch focus group NL1 agrees that an information campaign would work (similar to how people were made aware of separating plastic from other trash through advertising, e.g. at bus stops), but that they would need tangible tips on how to change user practices. And in the Danish focus group DK1, several of the participants support the idea that if people were better informed about the energy consequences of ICT, they would change their use and save energy. However, it is also stated by some that people already know that ICT consumes energy – and that despite this, people do not save on the energy consumption. But maybe the reason for this is that the main focus in relation to energy saving has not been on ICT in general.

> Clara: Well, people already know the things about switching off the light and that they should wash clothes at a lower number of degrees and things like that. I think that with IT, one could really do much more in order to increase awareness about this.

A critical voice regarding the effectiveness of more information is also raised in the Dutch focus group NL2, as the majority of the participants in this focus group (with environmental students) do not think that they would change their use of ICT if they had more information.

The above indicates that more information could be needed, but that this information needs to be specific and tailored the young people and their everyday life.

Technical improvements

The idea of solving the problem of high energy consumption related to ICT through technological improvements came up in many focus groups. This indicates a general trust in technological development as a way of solving the environmental problems of ICT. Also, technological solutions seem more attractive to many participants as this could be a way of reducing the environmental impact without changing daily practices.

One of the suggestions is to develop better (and perhaps more expensive) devices that can keep for longer before they need to be replaced. An example is Jinka from the Dutch focus group NL2. She would like to see higher quality in products in general (not only ICTs). She likes to buy less stuff of better quality instead of buying something new every time, although the new stuff might be cheaper. Her motivation to buy Apple

products is also derived from her assumption that these products last longer. In response to this, Astrid says that it would become too expensive; quality is always more expensive. Jinka answers that in the end, the so-called cheaper products will cost you more because they break down sooner. Astrid states that this might be true, but the problem is that often you do not have much money so you will be forced to buy something cheap. Jinka explains how she likes to postpone buying new things in order to save money and be able to buy more expensive and more sustainable things.

Favouring technological solutions can also in some cases be seen as a way of re-delegating the responsibility for reducing energy consumption and mitigating climate change to *other* actors such as the producers of ICT devices and internet services or the energy providers (several focus groups talked about "green electricity" as the best solution).

Several focus groups also talked about the possibility of developing devices that "can do everything" and in this way reduce the number of devices needed. This relates to a classical discussion within studies of ICT about the convergence of technologies. For instance, the participants in the German focus group DE2 talked about smart phones that can do "everything" and in this way replace other devices like MP3 players, tablets etc. Thus, the female participant B1 says:

> Well, I believe for myself, in order to change the future here […] if I will buy a new mobile phone, then I will buy one that can do all things for me that I need. Because then I wouldn't have to own a notebook and a mobile phone and an mp3-player and who knows what, but I will try to get a device, that I can use for everything together […]. I don't know how good that would be, but it seems to be the most logical conclusion to me. [..] Not always buy everything new, […] only when really necessary. And then really pay attention to the energy efficiency […].

Some focus group participants talked about how they already today find benefits in having smart phones that "substitutes" other devices. For instance Layla from the Danish focus group DK2, who explains that she has "everything" in her smart phone and if it was not for the smart phone, she would need a laptop and a TV in her own room at home:

> Layla: Really, if it was not for smart phones, and I just had an ordinary phone to make calls and write, then I would need a TV or laptop on my room, 100% [i.e. "for sure"], because then there would be nothing. But now I have all these things, so I don't even use my laptop, because I have everything on my iPhone.

Similar statements came in other focus groups, e.g. the Norwegian focus group NO1:

> Jens: I would have managed without most of the ICT equipment, except the mobile phone.
> Thomas: Yes, the same here. We can watch Netflix on the phone too.
> Jens: Mm.
> Thomas: It's almost like an IPad.

Thus, the potential of reducing the number of devices by acquiring "multi-functional" devices like smart phones seems to be an interesting possibility in relation to reducing the environmental impact of ICTs – and also an idea that seems to resonate with the thinking of many young people.

Using ICT to save energy in other consumption areas

Ideas on how ICT can be used to reduce energy consumption within other consumption areas were few. The participants generally found it challenging to come up with suggestions. Among the few were replacing neon signs in cities with internet advertisements (AT1), use ICT to inform about the energy consumption related to

transport and help to live more sustainable (AT3) and – on a more abstract level – use ICT to "dematerialise" consumption (NL2).

Other ideas

Above, the ideas and suggestions that got support by most focus groups have been described. In addition, there were also other ideas that came up either in just one focus group or as part of the participants' descriptions of their current practices. These include reducing the light intensity of screens (on smart phones), reducing printing (reading on ICT devices instead), using energy saving apps and modes on smart phones and use eco-saving programmes on computers. Several of these have been mentioned previously as part of the description of the participants' understanding of the relation between ICT and energy use – and will not be explored further.

Part III: Final analysis and conclusions

10. Overall analysis and discussion of results

This chapter combines findings from the mapping of ICT and energy consumption (chapter 3) and the literature review on young people's use of ICT (chapter 5) with the findings from the focus groups (chapter 7-9). The main focus is on key findings in relation to (trends in) young people's use of ICT and energy (chapter 7), young people's interpretations of the link between ICT and energy/climate change, including their understanding of their own personal role and responsibility (chapter 8) and the ideas and possible "entry points" for influencing young people's ICT usage in a more environmentally-friendly direction (chapter 9).

10.1 Young people's use of ICT – and the energy implications

The focus groups show how the use of ICTs is an integrated part of young people's everyday practices; especially in relation to their communication with schoolmates and friends, for entertainment and for school-related work. The last-mentioned applies, in particular, to young people within educations with an emphasis on written exercises like reports etc. (e.g. university students and pupils at general secondary schools). Also, the focus groups show that the main devices used by the young people are mobile/smart phones, laptops and TV sets – often supplemented by a few other devices (like tablets, MP3 players and game consoles).

Like the literature reviewed in chapter 5, the focus groups do not indicate significant gender differences with regard to the use of ICT. However, there seems to be some minor differences that can be important to keep in mind. First of all, like the literature reviewed indicate, the focus groups also indicate that young men more often spend time on playing games (both online and offline games) – typically on game consoles or on PCs. In addition, the questionnaire results indicate that while the gender differences with regard to mobile/smart phone use seem few, the male participants seem to use laptops more intensively for music and video/TV steaming than the female participants. Also, there is a more widespread desktop use among the male participants (perhaps due to a higher frequency of use of desktops for gaming among the male participants).

The focus groups also indicate differences related to type of education: As already mentioned, participants within educations with many written exercises such as universities and general secondary schools seem to use laptops more intensively and for longer time compared to participants within other educations like vocational schools and apprenticeship. This also influence which devices that are used for other activities not related to school work; thus, it seems that participants within educations with a considerable amount of computer-related work also more often use their computers to access social media like Facebook and more entertainment-related activities such as watching YouTube videos compared with the other group of participants. This is often done through multi-tasking by having Facebook or other internet-sites open in other windows while doing school work. In comparison, participants from vocational schools or without job or education (like the Danish focus group DK2) seem to prefer mobile devices like smart phones or tablets for accessing social media, while they still typically use laptops for activities like video and TV streaming. That computers are in particular used for school-related work by many participants is also found by other researchers (cf. chapter 5).

Interestingly, the focus groups do not confirm the pronounced role of fashion and style that has been identified by other studies, particular in relation to mobile/smart phones (see chapter 5). Thus, the focus groups did not include much discussion among the participants about having "the right" phone or about the participants' aspirations for specific phone models or brands. There might be different reasons for this: First

of all, the aim of the focus groups was not to go into detail with the participants' aspirations for new ICT devices. Secondly, the reviewed studies were carried out at a time (2002 and 2005) when mobile phones might not have been as trivial and normalised a device in the everyday life of young people as it seems to be today. On the other hand, the focus groups demonstrate that *not* having a mobile/smart phone clearly challenges existing ideas among young people about what is normal. Also, several focus groups seemed to agree that one "needs" to have a mobile phone or (increasingly) a smart phone in order to be included in the communication circles developed around particularly smart phone apps like WhatsApp or Facebook. This demonstrates how integrated and normalised the use of ICTs (in particular smart phones and to some degree also laptops) has become in relation to practices of mediated communication and interaction between peers. Thus, it seems that while previous studies found that the ownership of a specific phone to some degree decided inclusion or exclusion of a social group (due to the phone being a marker of social distinction), the focus groups in this study indicate that the question today more is about having access to the "right" forums like Facebook or WhatsApp in order to be included in the communication circles among the peers. This also confirms previous studies showing that young people's use of ICTs is closely related to creating meaningful social interactions and a sense of belonging. Access to social media often depends on having a smart phone with the right applications.

Always being online and accessible is a recurrent theme in many focus groups, which particularly came up in relation to discussions about peer-related communication via especially Facebook and WhatsApp. Many participants described how they feel uncomfortable (e.g. "lost") if they experience (longer) disruptions in their access to the internet and social media. This is to a high degree about a felt need to follow the continuous stream of messages from friends and schoolmates. However, it also relates to the widespread use of ICTs (in particular smart phones) for entertainment, diversion and to fill in gaps between other activities. Interestingly, many participants also raised a critical voice in relation to the downsides of always being online and accessible, and several talked about it as being "addicted" to the use of ICT. Firstly, many felt that the continuous flow of messages sometimes caused distraction or stress, and several had even developed strategies to avoid this in cases where they needed to keep focused on a certain activity (e.g. writing a school report). Secondly, several also raised the question whether the mediated interaction via online media was less authentic compared to physical, face-to-face co-presence and maybe even "anti-social" as the mediated interaction in some cases removes their attention from their interaction with co-present others. In this way, the focus groups show a degree of dilemma or ambivalence among young people in relation to always being online and accessible.

Multi-tasking was widespread among the participants – both as multi-tasking on a single device (e.g. having several windows open at the same time on the laptop) and as using two or more devices simultaneously (e.g. combining laptop and smart phone). And very often multi-tasking seems to involve mediated interaction with friends and schoolmates of some kind. As described in Chapter 5, Gross (2004) finds that online communication like chatting or sending messages via e.g. WhatsApp might in many cases be preferred for physical co-presence or voice calls because it facilitates multi-tasking.

In terms of resource use (including energy consumption), the focus groups identify a number of energy-intensive trends and practices related to young people's use of ICT. At a general level, the high integration of ICTs in the everyday practices of young people as well as the habit of always being online and accessible results in an extensive use of ICTs (often as multi-tasking) – and thus in a generally resource-intensive everyday life of young people when it comes to ICT. The high integration of ICTs in everyday practices also represents one of the most important "barriers" for changing young people's ICT usage in a less resource-intensive direction.

At a more specific level, the focus groups identify a number of present practices and trends that – on the basis of the literature review of studies on ICTs and energy consumption in chapter 3 – can be singled out as particular energy-intensive or problematic in wider, environmental terms. These are (in summary):

- Video streaming is widespread and seems increasing: The focus groups show that streaming of audio-visual content via the internet is very widespread among young people. This is highly connected to the experience of convenience in relation to video streaming as compared with watching movies and serials on traditional broadcasting television. However, as video streaming involves high data traffic (especially when streaming content in high definition), it also involves a high internet-related energy consumption as well as high energy consumption on the devices used. The findings of the focus groups are in line with other studies indicating that video streaming is increasing rapidly at the moment. For instance, a recent media consumption survey from the Danish broadcasting company (Danmarks Radio) concludes that the time that Danish population spend on viewing traditional broadcast-television is in decline (and has been declining for new three years) and that the decline is biggest for the younger age groups. The survey also found that for the age group 15-30 years, video streaming now represents about one quarter (22%) of their total time spend on viewing video and television content – and Netflix alone represents 6% of their total viewing time, while YouTube represents about 3% (Danmarks Radio 2014). All in all, video streaming seems to be one of the most important drivers for increasing energy consumption for ICT at the moment, in particular among young people.
- Sharing photo/video clips via social media: In addition to video streaming, the focus groups and the questionnaire also indicate that sharing photos and video clips via social media is widespread. Even though this is not as energy-demanding as video streaming of movies and TV serials, this might also involve significant energy consumption. Particularly if the sharing of photo and video clips happen via use of mobile broadband (3G/4G), which involves higher energy consumption for data transmission compared with wi-fi and Ethernet (cable) connections.
- Devices rarely used: The focus groups also indicate that young people often acquire ICT devices that they only rarely use (e.g. tablets and game consoles). As high resource consumption is associated with the manufacturing and disposal of these devices, the acquisition of rarely-used devices seems problematic in an environmental perspective. Especially as some of these devices (in particular tablets) do not offer features or uses that are much different from those of smart phones and/or laptops.
- Standby: The focus groups show that it is a widespread habit among young people not to switch off ICT devices between uses. Especially in relation to laptops, only few of the participants indicate that they shut down the laptop while the majority typically just close the screen (putting the computer in hibernation mode). Similarly, only few avoid standby consumption in relation to other ICT devices like TV sets or game consoles. At the same time, there is actually some awareness among the participants about the problem of standby energy consumption – but this knowledge is rarely converted into new practices.
- Keeping old phones as spare phones: It seems to be widespread that young people keep their old phones as a spare phone when they get a new one. In many cases, the old phones are not technically obsolete and they could in principle be reused by others – e.g. by their personal friends or through a collecting scheme. Promoting reuse could be a way to reduce the environmental impact related to the manufacture and disposal of ICTs by reducing the overall renewal rate. In relation to this, the habit of keeping old phones as spare phones instead of delivering them for reuse is problematic.
- Limited focus and awareness of correct disposal: The focus groups show that the participants are generally not aware of the importance of correct disposal of ICT devices. This is problematic in an environmental perspective.

A campaign for promoting a less resource-intensive use of ICT among young people should in particular address these widespread practices and occurring trends.

10.2 Young people's understandings of ICT and energy and climate – and willingness to change practices

The focus groups show little interest in and awareness of the environmental problems related to the use of ICT among young people. The awareness and interest in environmental problems in general also seem limited. Overall, the focus groups participant found it difficult to establish and elaborate the links between their personal use of ICT devices and environmental problems related to energy consumption etc. One important reason for this might be that the "invisible nature" of the energy consumption associated with their daily use of ICT. This applies in particular to the embodied and internet-related energy consumption of ICT, whereas there was some knowledge about the direct electricity consumption.

The focus groups also indicate that most young people question the relevance of saving energy in relation to ICT. They do not in general think that ICT consumes much energy in itself or compared with other areas like transport or manufacturing, which – in their view – makes it less relevant to focus on ICT in order to save energy. Also, they think that the potentials for saving energy through changing their personal use of ICT are limited and similar to a "drop in the ocean". Furthermore, young people seem to re-delegate the responsibility for saving energy in relation to ICT to others – in particular the producers of ICT devices (for designing devices with a lower environmental impact) or the internet service providers (for reducing the energy consumption of data centres and data transmission). Finally, they seem to have a strong confidence in the potentials for technological improvements in relation to developing more energy efficient devices and services as well as replacing fossil fuels with renewable energy as a way of solving the climate problems through "green electricity".

In this way, the focus groups do not indicate a general interest in or willingness among young people to change their personal use of ICT in order to reduce the energy consumption and environmental impact. Even among the most environmentally interested participants, the motivation for adopting energy efficient ICT user patterns was limited. The reason for this might partly be that the participants did not in general see many options for how to save energy. Several times, the focus group discussions ended up in a kind of "either or" position; either you live without ICT in order to save energy (by many described as "going back in time") or you use ICT and do not save energy. In this way, the focus groups show a lack of ideas among young people in terms of how to save energy without changing one's ICT user practices completely. This might be related to the limited knowledge and awareness about ICT and energy consumption among the young people and therefore a lack of more elaborated and nuanced ideas. Also, the general lack of willingness to change ICT usage seems also closely related with the inconvenience that changing the use of ICT might cause.

While the knowledge and awareness among young people about the energy implications of their use of ICT seems limited on the general level, the focus groups showed that given the time to discuss the relation between ICT and energy, the participants actually came up with rather elaborated descriptions of (especially) the direct electricity consumption. This knowledge is mainly based on the participants' practical (and sometimes very physical and tangible) experiences of the energy use of their own ICT devices: Experiences with how long it takes to discharge a battery (and how the life-time of battery charges are related to different uses) and with how warm handheld devices become dependent on what they are used for. This shows that young people in general possess a practical (but probably often tacit) knowledge about the energy use of ICTs, which can be "activated" and made explicit through discussions like those in the focus groups. However, there are obvious limits and "blind spots" related to this practical knowledge. First of all, it is

mostly related to portable devices with integrated batteries (mobile/smart phones, tablets and laptops). Secondly, it only relates to the direct electricity consumption of devices and does not include the embodied or internet-related energy consumption. However, addressing the practical experiences of energy consumption might be an "entry point" for making the question of ICT and energy consumption present and intelligible for young people.

While practical experience seems to be the main source of (more detailed) knowledge about the relation between the use of ICT and (direct) electricity consumption, the focus groups also identify other types of sources of information about ICT and environment. Among these secondary sources, the most important ones seem to be: The school (e.g. on conflict minerals used in mobile phones or general themes like climate change), popular TV science shows, parents (e.g. parents who works with environmental issues professionally) and the internet (websites).

Interestingly, their friends and classmates (peers) as source of information did not come up – probably showing that ICT and energy is not a theme that young people talk about among themselves. However, in several focus groups the participants were highly engaged in sharing practical experiences (e.g. "tips and tricks") on how to save energy and extent the life-time of battery charges on particularly mobile/smart phones.

10.3 Reducing the energy consumption of young people's ICT usage – ideas and entry points

Overall, the participants think that it is difficult to change the use of ICT in order to save energy. It seems to be the consensus across the focus groups that it would be an "upstream" experience for the individual to change his or her practices, because ICT is so highly integrated in the everyday practices. The normalisation of ICT usage – even in an embodied sense – also represents a major challenge of changing habits and daily routines. Also, the focus on individual responsibility for changing practices represents a problem. This is illustrated by the analogy made by one of the German focus groups participants between changing ICT usage and being on a slimming diet; if everyone else is continuing their usual practices, it would be difficult to maintain new energy-saving habits and routines.

This suggests that policies and campaigns aimed at promoting energy-saving ICT usage should address this as a collective task rather than a responsibility to be raised by young people individually. Also, this is in line with studies showing that young people are highly influenced by their peers in relation to topics like environment and energy saving (see chapter 5). This influence can both be negative and positive in environmental terms. Negative, if it is being associated with being "non-cool" to be interested in the environment and saving energy. Positive, on the other hand, if several young people within a local community could be made interested in saving energy in relation to ICT and in this way influence and motivate each others to keep a focus on this and develop and maintain new energy-saving routines. Again, this is in favour of addressing the problems of young people's energy-intensive use of ICT as a collective challenge rather than an individual challenge. This is also in line with the ideas behind peer-to-peer education, which is a key method in this project (useITsmartly).

Another challenge for involving young people in saving energy in relation to their ICT usage is related to their understanding of economy (saving money) as a main incentive for changing practices. On one hand, this strong focus on money-saving is a little surprising, as financial savings are often not in general a main driver for saving energy among adults. But this might reflect that young people often have limited budgets and therefore are particular aware of financial concerns. On the other hand, only a minority of the

participants pay their own energy bill as most of them are still living at home with their parents. In this way, the idea of saving money is a more "theoretical" or abstract idea than a real and practical situation for them. This also makes it obvious that even if money-saving actually would be a relevant incentive for this group, it is only few that would have personal benefits (in economical terms) from saving direct electricity consumption (not to mention the embodied and internet-related energy consumption). Thus, it is not likely that saving money would be a relevant "entry point" in relation to raising young people's interest in and awareness about ICT and energy saving.

Despite the general lack of interest in saving energy for environmental reasons and the critical perspective on their own possibilities for saving energy in relation to ICT usage, some of the participants seem to have developed ways to save energy in relation to their use of mobile devices (in particular mobile/smart phones). Even though this is not in general related to environmental concerns (but to extend the life-time of battery charges), this shows that energy saving routines are not completely absent in young people's use of ICT. The same goes for the few focus groups participants, who described other kinds of energy saving routines like switching off TV sets for the night (reduce standby consumption). Again, these routines are typically motivated by other things than the environment; e.g. in order to avoid an annoying sound from the television set during the night. In some cases these habits were influenced by the parents, which shows the positive influence from significant others on young people's own daily practices.

The focus groups participants also came up with a number of specific ideas on how to save energy in relation to ICT usage. These will not be repeated here (see chapter 9); instead, we will finish this chapter by identifying the possible entry points (or enablers) for making young people interested in ICT and energy consumption and changing practices that this study has identified. This will be based on a combination of the literature review (chapter 5) and the focus groups findings.

Entry points

Two possible entry points have already been identified above: Addressing young people's practical knowledge about ICT and energy consumption as a way of making them aware of the energy implications of their ICT usage as well as addressing the widespread interest in methods to extend the life-time of battery charges on mobile devices (as a way of addressing energy saving habits). In addition, the study identifies other potential entry points (enablers) for addressing ICT and energy saving:

- Influence by parents and peers (and significant others in general): There are indications that significant others (in particular parents and peers) can have an important influence on motivating young people to adopt energy saving habits (e.g. avoiding standby consumption). This makes it important to also include the social network of young people in campaigns aimed at promoting ICT energy saving; in particular parents and the friends and schoolmates (peers).
- Addressing the negative implications of always being online and accessible – promoting a more "reflexive" use of ICTs: Even though most of the participants seem to like to always being online and accessible, many also describes downsides like distraction, waste of time and "unauthentic" interaction with others. In addition, the literature review identifies concerns among some groups of young people with regard to negative physical or health effects of intensive ICT usage (e.g. that their eyes hurt after long time in front of the screen). Addressing this kind of negative implications of intensive ICT usage could be a way of opening a discussion about a more "reflexive" use of ICTs, which could – among other things – address the simultaneous use of several devices (multi-tasking) or consider a more deliberate use of online gaming and video streaming (e.g. avoiding the "phlegmatic" or disinterested "browsing" on YouTube that were described by some participants, etc.).

- Addressing the problem of rarely used devices – reduce acquisition of new devices: Many of the participants have experiences with owing devices that they only rarely use. In addition, several focus groups discuss how they could do with fewer devices as some devices seem to "overlap" each other with regard to functionalities and features. For instance, if one already has a smart phone, the "additional" user features associated with a tablet seem limited to many participants. Thus, addressing young people's thoughts about this in order to develop a more reflexive approach to the acquisition of new devices could be a way of reducing the total amount of ICT devices. This would be particularly relevant in relation to mobile devices, as the main environmental impact of these in general is related to the embodied energy consumption.

11. Conclusion

In this concluding chapter, we will summarise the main *overall* findings of the study and point at some of their implications for how to design interventions and campaigns aimed at supporting young people in adopting a less energy-intensive use of ICT.

The study demonstrates how ICT today has become highly integrated in young people's everyday practices, which makes it particularly challenging to reduce ICT-related energy consumption through changes in their daily use of ICT.

With regard to differences in how young people use ICT, the study finds no marked gender differences. With regard to designing interventions and campaigns, this indicates that gender should not be a main topic in relation to addressing young people's ICT usage (except for – perhaps – playing games, which seems to be more widespread among young males). Instead, the focus groups indicate that type of education plays a much more important role for young people's ICT user patterns; especially in relation to the use of computers (typically laptops), which are much more widespread among young people in educations with many written assignments (e.g. general secondary schools or universities) compared with those in educations that are less based on written exercises (e.g. vocational schools). Thus, education should be in focus when developing interventions and campaigns targeted young people.

The study identifies a number of energy-intensive trends and practices that should be particularly in focus in interventions and campaigns. At the overall level, the integration of ICT in most everyday practices and the habit of always being online and accessible implicate an energy-intensive everyday life. At the specific level, video streaming, photo/video sharing via social media, the rare use of some devices, standby energy consumption, the habit of keeping old phones as spare phones (instead of delivering them for reuse/recycling) and the limited awareness of correct disposal were identified as particular important practices to address in interventions and campaigns.

With regard to young people's understanding of the link between personal ICT usage and the environment, the study shows little interest in and awareness of the environmental problems related to the use of ICT and that young people find it difficult to establish the link on a conceptual level. Also, young people seem to question the relevance of saving energy in relation to their use of ICT; primarily because they believe that ICT does not consume much energy and that the potential energy savings from changing their own use of ICT are limited (like a "drop in the ocean"). This might represent one of the most important challenges for developing interventions and campaigns addressing young people's use of ICT. It is therefore important to design approaches that take into account that young people in general find it difficult to see the relevance of addressing their use of ICT as a subject for energy saving. Thus, interventions should convey the connection

between ICT and energy and the importance of reducing ICT-related energy consumption in an accessible and illustrative way.

Even though the general knowledge about ICT and energy and climate change is limited, the focus groups show that young people actually do posses an often rather detailed knowledge about the *direct* electricity consumption of *mobile* devices. This is mainly due to practical and sometimes even very tangible experiences with how the life-time of battery charges and the heat production of mobile devices depend on how they use these devices. Even though this practical knowledge is primarily limited to mobile devices and the direct electricity consumption, it seems to be a good idea to design interventions or campaigns that benefit from this knowledge (e.g. by using young people's experiences with how some uses are "draining" their batteries to make more general points about the energy implications of their ICT usage).

The focus groups do not find a general interest in or willingness among young people to change their personal use of ICT in order to reduce the energy consumption and environmental impact. Important explanations for this reluctance are the above-mentioned understanding that ICT is not particularly important in relation to energy and climate. In addition, young people find it difficult to change their use of ICT as this would often be inconvenient due to the high integration of ICT usage in their everyday life. Again, this is an important challenge that should be addressed in the design of interventions and campaigns.

Overall, changing the personal use of ICT was described by the focus group participants as difficult and by many compared to an "upstream" experience that would involve much efforts and inconvenience. The high integration of ICT in young people's everyday practices challenges the idea of promoting energy savings through campaigns targeting individuals and their individual choices and habits. As one focus group participant explained, the challenges of changing one's personal ICT usage would be similar to the challenges of being on a slimming diet while everybody else would be continuing their usual eating habits. Thus, it would be felt as a personal "burden" to (for instance) reduce the use of video streaming if everybody else continue to stream movies.

The integration of ICT in young people's everyday practices and the associated "upstream" experience related to changing individual habits is one of the key findings of this study. It challenges the idea of targeting young people as individuals and the idea of young people's use of ICT as being a result of rational choices that might be changed trough providing them with new information. Instead, interventions and campaigns should be designed to facilitate (also) collective discussion and action among young people. An approach that would be in line with peer-to-peer education, which is a key methodology in the useITsmartly project. In addition, the focus groups demonstrate that the influence of significant others is particular important for the adoption of energy saving habits, which also favours methods based on peer-group interaction. In relation to this, educational institutions like schools and universities would also be important to address in the design of interventions.

Furthermore, young people's use of ICT is a result of the interaction of heterogeneous elements; particularly the influence from the development of new technologies and services seems to be important as a constituting element of young people's ICT user practices. Therefore, in order to weaken the "upstream" experience related to changing practices, interventions and campaigns should also include and address the actors involved in designing and developing ICT technologies and services. Ideally, environmental concerns should be integrated in the design of new products and services – also in relation to making it easier for the users (including young people) to use the technologies in less energy-intensive ways. The useITsmartly project

does not include these actors as partners, but it would be relevant to consider how to be open also for ideas on how to design ICT products and services in ways that would facilitate a less resource-intensive daily use.

In addition to the above challenges and limitations, this study also identifies a number of potential "entry points" (enablers) for addressing ICT and energy saving. Besides the practical knowledge about the direct electricity consumption of mobile devices (mentioned previously), these possible entry points include: Utilizing parents and peers as an important channel for influence (e.g. through peer-to-peer education), addressing the negative implications of always being online and accessible and addressing the problem of rarely used devices (including promoting the use of "multi-functional" devices like smart phones that can substitute other devices and in this way reduce the total number of devices that young people have and use).

In relation to the negative implications of always being online and accessible, it is important to note that the focus groups identified a general concern among young people with regard to their intensive use of ICT. The use of ICT seems to be associated with some ambivalence between seeing the usage of ICT as both being a meaningful and enjoyable activity as well as associated with distraction, waste of time and sometimes even "unauthentic" interaction. This indicates a "tension" and an interpretive flexibility related to the use of ICTs that could form the basis for promoting a more "reflexive" use of ICT among young people. A "reflexive" use that could also bring environmental issues more into the forefront.

12. Literature

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Appendix 1: Questionnaire used in focus groups

Use of IT in daily life

Thank you for participating in our project about young people's use of IT and energy. This questionnaire includes a few questions about you and some about your use of information technology (IT) in your everyday life. Please answer the following questions.

1. How old are you? _____ years

2. Your gender? ***(please write)*** _____

3. What is your housing situation? ***(please mark)***

- ☐ I live with my parent(s)
- ☐ I live alone
- ☐ I live with my girlfriend/boyfriend
- ☐ I live with my roommates (share an apartment/house or similar)
- ☐ I live in a dormitory

4. Which of the following devices do you use in general? ***(please mark all relevant)***

- ☐ Television at home, which I share with others (e.g. television in living room)
- ☐ Television in my own room
- ☐ Laptop
- ☐ PC at home
- ☐ PC at school
- ☐ Mobile phone
- ☐ Smart phone
- ☐ Tablet (e.g. iPad)
- ☐ Game console (e.g. Xbox, PlayStation, Nintendo Wii or similar)
- ☐ MP3-player (e.g. iPod)
- ☐ Other *(please write)*: _____

5. Do you sometimes use a laptop? ***(please mark)*** ☐ Yes ☐ No

If yes:

5.1 How many hours do you use a laptop on a typical weekday? ***(please mark)***

☐ Less than 30 minutes ☐ About 1 hour ☐ About 2 hours ☐ About 3 hours ☐ More

6. Do you sometimes use a stationair PC? ***(please mark)*** ☐ Yes ☐ No

If yes:

6.1 How many hours do you use a PC on a typical weekday? ***(please mark)***

☐ Less than 30 minutes ☐ About 1 hour ☐ About 2 hours ☐ About 3 hours ☐ More

7. Do you sometimes use a mobile or smart phone? ***(please mark)*** ☐ Yes ☐ No

If yes:

7.1 How many hours do you use a mobile or smart phone on a typical weekday? ***(please mark)***

☐ Less than 30 minutes ☐ About 1 hour ☐ About 2 hours ☐ About 3 hours ☐ More

8. Do you sometimes use a tablet (e.g. iPad)? ***(please mark)*** □ Yes □ No

If yes:
8.1 How many hours do you use a tablet on a typical weekday? ***(please mark)***

□ Less than 30 minutes □ About 1 hour □ About 2 hours □ About 3 hours □ More

9. Do you sometimes use a game console (e.g. PlayStation)? ***(please mark)*** □ Yes □ No

If yes:
9.1 How many hours do you use a game console on a typical weekday? (please mark)

□ Less than 30 minutes □ About 1 hour □ About 2 hours □ About 3 hours □ More

10. How often do you use a laptop or PC for…
(please mark the answer that applies best to your use)

	Daily	**At least weekly (but not every day)**	**Less than every week**	**Never**
Send/receive photos or video by e-mail				
Video calls (e.g. Skype)				
Upload or watch photos or video on social media (e.g. Facebook or Instagram)				
Upload photos or video to YouTube/Wimeo or similar video-sharing				
Streaming music via the internet (e.g. Spotify)				
Streaming video or television programmes from the internet (e.g. YouTube, Wimeo, Netflix or national television website)				
Download video, music or podcasts to your own device (not streaming)				
Online gaming (playing games on the internet, e.g. World of Warcraft or free online games)				
Play games (not online gaming)				
Participate in virtual worlds (e.g. Second Life or similar online virtual worlds)				
Read news or gossip on websites				
Use search engines (e.g. Google)				
Download reports or other kinds of larger text documents				
Photo or video editing (e.g. using Photoshop)				

11. How often do you use a mobile phone/smart phone or tablet for…
(please mark the answer that applies best to your use)

	Daily	**At least weekly (but not every day)**	**Less than every week**	**Never**
Send/receive photos or video by e-mail				
Video calls (e.g. Skype)				
Upload or watch photos or video on social media (e.g. Facebook or Instagram)				
Upload photos or video to YouTube/Wimeo or similar video-sharing				
Streaming music via the internet (e.g. Spotify)				
Streaming video or television programmes from the internet (e.g. YouTube, Wimeo, Netflix or national television website)				
Download video, music or podcasts to your own device (not streaming)				
Online gaming (playing games on the internet, e.g. World of Warcraft or free online games)				
Play games (not online gaming)				
Participate in virtual worlds (e.g. Second Life or similar online virtual worlds)				
Read news or gossip on websites				
Use search engines (e.g. Google)				
Download reports or other kinds of larger text documents				
Photo or video editing (e.g. using Photoshop)				
Monitor your health (e.g. using pedometer apps)				

12. How often do you use a game console for…
(please mark the answer that applies best to your use)

	Daily	**At least weekly (but not every day)**	**Less than every week**	**Never**
Online gaming (playing games on the internet, e.g. World of Warcraft or free online games)				
Play games on your device (not online gaming)				
Participate in virtual worlds (e.g. Second Life or similar online virtual worlds)				

Appendix 2: The guide for the focus groups

Intro I (3 minutes)
Welcome
The moderators present themselves
Introduce the topic of the project ("what is it all about?")

Survey (5-10 minutes)
Hand out the questionnaire + pencils and ask the participant to fill it in (if not done before focus groups – in that case: Ask participants to hand over questionnaires).
When it looks as everyone has finished completing the questionnaire, ask if "everyone is finished" – and if so, collect the questionnaires.

Intro II (3-4 minutes)
Introduce the topic of the focus group (what the focus group is about)
Explain what a focus group is – including explaining the expectations to the role as participant as well as the moderator(s). See also section 1.3.

Topic 1 – Presentation and use of IT (20 minutes)
A round where participants tell about themselves and their use of IT

If a rather homogenous group with regard to patterns of IT usage, **round off** by asking:

- Do you know people at your own age that use IT differently from yourself? And how do they use IT?

Topic 2 – Personal use of IT and energy / climate change (20 minutes)
Discussion-starter: IT can be used for many different things. What kind of role (positive or negative) do you think that your personal use of IT plays in relation to energy consumption and climate change?
Tools (optional): Cards (Appendix 2).

Both *direct* energy consumption (energy use by devices) as well as *indirect* (energy consumption related to IT infrastructure) and *derived* energy impacts (impact on energy consumption within other areas) can be discussed.

Follow-up questions (used for moderating, ***if needed***):
- Can you give any examples of how your daily use of IT affects the climate?
- Do you think about how your daily use of IT might have an impact on energy consumption or climate change? For instance when you buy new products/gadgets? When you use IT? Or when you dispose old products/gadgets?
- Do you in general think about the environment in daily life? Can you give examples of how you think about the environment?
- What kind of IT uses do you think consumes most energy?

Cards of different IT uses (Appendix 2) *might* be used to facilitate the discussion (optional).

If participants do not describe/discuss where they get their knowledge about IT and energy, end Topic 2 by asking:

- Where do you get knowledge about IT and energy consumption and climate change from?

****** 5 MINUTES BREAK (if needed) ******

Topic 3 – Changing use of IT / saving energy (Duration: 25 minutes)

Discussion-starter: Energy consumption of people's use of IT is increasing. Today, households use more energy for IT than for many other things – such as lighting or freezers & refrigerators. As a result, energy consumption for IT now contributes to greenhouse gas emissions and climate change. This raises the question of whether we should reduce energy consumption for IT.

What do you think about the idea of saving energy in relation to your own IT use?

After some discussion of this, introduce next discussion-starter:

Discussion-starter: Discuss how you could save energy in relation to your personal use of IT. What could you do different? And could you use IT in ways that would reduce other kinds of energy consumption?

Both *direct* energy consumption (energy use by devices) as well as *indirect* (energy consumption related to IT infrastructure) and *derived* energy impacts (impact on energy consumption within other areas) can be discussed.

Follow-up questions (used for moderating, ***if needed***):

- What kind of changes in IT use would you think of as reasonable? Why?
- What kind of changes in IT use would you think of as unreasonable or impractical? Why?
- What IT uses could you do without?
- What IT uses could you never do without?
- How could IT be used to save energy in other areas? And what would you think about this? Examples could be
    - Use IT for communication and save transport
    - Read text on screen instead of printing
    - Other examples?

Remember (among other things...)

- Check the audio(-visual) equipment before focus group (does it work properly?)

Remember to make observation notes during focus group – especially with regard to the interaction among the participants (e.g. non-verbal signs of disagreement)

Appendix 3: Guidelines for focus group summary and analysis

For each focus group, a 4-10 pages summary/analysis is prepared on the basis of the focus group transcriptions and the moderators' observation notes. In the following, the outline and content of this summary/analysis is described.

When preparing the focus group summaries, please follow the grid outlined in section 2 – but first some general comments on how to do the summaries and analysis (next section).

1. Introductory comments

The main part of the summaries should be a "condensation" of the focus group discussions. Thus, the summaries should represent or convey the content of the topic-related discussions in a "condensed" form.

It is important that your summary of the focus group discussion is valid and "loyal" to the participants' discussions *as well as* you should ensure that nuances and variations in expressions and statements are represented in the summary.

In relation to the first goal (ensure valid and loyal representations of the discussions), you should aim at using words and expressions that are as close as possible to the original words and expressions used by the participants. In addition, you should also include a number of selected, relevant quotes from the focus group; this can be excerpts that are particular illustrative of a specific statement, position, disagreement or exchange of opinions – or that give insight into how the participants articulate central concepts, ambivalences or distinctions. The quotes should be "word-for-word" transcripts of what the participants said (including indications of pauses – and who said what).

The quotes are translated into English. In relation to this, be careful to choose English wordings with a semantic content that is as close as possible to the meaning of the words/expressions in the original language. (By the way: This also applies to the summaries in general). It is recommended to consult English-English dictionaries to double-check the meaning of English words – for instance:

- Cambridge Dictionaries Online: http://dictionary.cambridge.org/
- Oxford Dictionaries: http://oxforddictionaries.com/

With regard to the second goal above (ensure that nuances and variations are represented in the summary), you should be careful to ensure that different understandings or positions are made "visible" in the summaries and the selection of quotes. For instance, if consensus is reached on a specific understanding or position, it is particular important to report any disagreements or alternative views that might have been expressed in relation to this consensus. This kind of disagreements/alternative views can give important insight into the complexities related to central concepts or illuminate important alternative understandings.

Also, it might seem that a focus group relatively easily reach consensus on a specific understanding/statement, but when looking closer into the "actual" expressions and statements of the different participants, it sometimes turns out that they operate with slightly different understandings of central concepts or terms. For instance, the participants in the Danish focus group at the "Aarhus Statsgymnasium" (held in late September) seemed to agree on a distinction between necessary versus unnecessary – or "superfluous" – IT uses. But some participants might think of Facebook as an example of a "necessary use of IT", while others regard it as superfluous; different interpretations that might, perhaps, be

related to different uses of Facebook (among other things). Such nuances and details are important for the analysis of the focus groups. For instance with regard to evaluating the degree of "interpretive flexibility" related to specific understandings/positions.

In addition, it is also important that the summaries indicate *to what degree* consensus is reached in relation to different understandings, statements or positions. Obviously, this will rely on a qualitative evaluation of how widespread agreement or disagreement (verbal or non-verbal) are among the participants in relation to a specific statement.

Include observational notes when relevant. For instance if several participants showed their disagreement with a specific statement by shaking their heads or in another way.

While the summaries should be "empirically grounded" in the sense that they should represent the focus group discussions in a valid, loyal and nuanced way, it is also important that you include *analytical comments and suggestions* in your summaries. Being moderator, you are the person with the most detailed knowledge about the focus group (including the verbal and non-verbal interaction), and your interpretations and analytical observations are therefore very important. Each section of the summary should conclude with your analytical comments and input for the further analysis.

2. Grid for summary and analysis of focus groups

The following grid should be followed when preparing the summary/analysis for each focus group.

I have included some explanatory comments for each section.

1) Time, place and participant recruiting

Give a short description of:

- How the participants were recruited. Including: How the first contact to the participants was made and who the gatekeeper/sponsor was – and some reflections on possible biases or risks of "priming" of the participant prior to the focus group.
- The focus group setting (a short description of the setting: Location? Noise? Were there late arrivals? Interruptions? Etc.)
- Other things with relevance for the interpretation of the focus groups?

2) Participants

Describe the composition of the focus group with regard to age, gender and educational background. Include also here a summary of the personal background information from the questionnaire that the participants complete before the focus group.

Make a short presentation of the focus group participants on the basis of what they told about themselves in relation to Topic 1 of the focus group (or later in the focus group). Use pseudonyms to ensure anonymity.

3) Group process and dynamics

This section includes comments and remarks regarding the process and dynamics of the focus group. This can be aspects that might be of importance for the interpretation and analysis of the focus group discussions.

For instance, in the Danish pilot, one of the participants was somewhat older than the others (24 years). Due to this age asymmetry, and the fact that he was also the participant who spook most of the time, he seemed to

have an important influence on the focus and dynamic of the focus group discussions; several times, he was the person who introduced a new topic/aspect, and he also took a "leading role" a few times acting almost like a discussion facilitator.

4) Use of IT

This section summarises the participants' descriptions of their own use of IT; this will mainly be based on the individual presentations in Topic 1 (but – of course – also descriptions that might come up later in the focus group in relation to Topic 2 and Topic 3).

Present the participants' individual IT uses (one by one), and follow up with general observations with regard to differences and similarities between the participants with regard to their use of IT etc. Also, include a summary of how the focus group participants think about their own use of IT compared with other young persons (if this was discussed in the focus group).

NB! Remember to include a short summary of the results of the questionnaire that the participants completed before the focus group. Focus on patterns with regard to the kind of devices that the participants use, for how long they use them and for what purposes. Also, add an appendix with a summing up of answers for each question.

5) Personal use of IT and energy and climate change

This section summarises the participants' discussion of the role (positive/negative) that their personal use of IT plays in relation to energy consumption and climate change.

The summary will (of course) particularly be based on the discussion in relation to Topic 2 – but if the participants also discuss the link between IT and energy consumption/climate change later in the focus group (i.e. in Topic 3), this should also be included here.

Of particular interest is to what degree the participants see a link between (their own) use of IT and the energy/climate issue. Also, it is interesting to know their sources of knowledge about IT and energy/climate.

6) Changing use of IT?

This section summarises the focus group's discussion of the idea of saving energy in relation to use of IT – and what the participants think about how they could save energy themselves.

Depending on how the discussion of Topic 3 went, the summary might be split into two parts: The first part dealing with the general/principle idea of saving energy in relation to IT use, the second dealing with the discussion on how to save energy more specifically. However, in most focus groups, these two themes might be closely intertwined, and in these cases it might not make sense to make such a distinction.

When preparing the summary, it is of particular importance to include discussions and remarks on possible "barriers" or "drivers" for change: What do the participants think could help/encourage/motivate them to change their use of IT in order to save energy (direct as indirect or derived energy consumption)? What kind of challenges/problems/barriers do the participants point out as important in relation to saving energy on IT?

Also, the summary should give a general impression of to what degree the participants find it reasonable to change their IT usage in order to save energy or not.

Finally, it is also important that the summary describes the participants' general interest and awareness with regard to environmental issues; e.g., do they save energy in relation to other consumption areas?

7) Other interesting aspects

In addition to the above, there might also be other interesting discussions, topics or themes that came up during the focus group – and which might be important for the discussion on young people's use of IT, energy and energy saving. Please include a summary of these in this section. This can also be more general observations or analytical comments across the different topics.